Haley & Aldrich, Inc.

REPORT ON SUBSURFACE INVESTIGATION AND FOUNDATION DESIGN AND CONSTRUCTION RECOMMENDATIONS ONE LINCOLN STREET DEVELOPMENT BOSTON, MASSACHUSETTS

Note pocket

Consulting

Geotechnical Engineers

Geologists and

Hydrogeologists

REPORT ON SUBSURFACE INVESTIGATION AND FOUNDATION DESIGN AND CONSTRUCTION RECOMMENDATIONS ONE LINCOLN STREET DEVELOPMENT BOSTON, MASSACHUSETTS

by

Haley & Aldrich, Inc.
Cambridge, Massachusetts

for

Metropolitan/Columbia Plaza Venture
Boston, Massachusetts

File No. 06691-00

April 1989

Haley & Aldrich, Inc.

Consulting
Geotechnical Engineers,
Geologists and
Hydrogeologists

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5 April 1989
File No. 06691-00

Metropolitan/Columbia Plaza Venture
200 State Street, 12th Floor
Boston, Massachusetts 02109

Attention: Mr. Paul Chan

Subject: Proposed One Lincoln Street Development
Boston, Massachusetts

Gentlemen:

We are pleased to submit five copies of our final design report entitled "Subsurface Investigation and Foundation Design and Construction Recommendations, One Lincoln Street Development, Boston, Massachusetts". This report summarizes the results of recent subsurface explorations and presents foundation design criteria and construction recommendations for the proposed One Lincoln Street Development in Boston, Massachusetts. A draft of this report was submitted to Metropolitan/Columbia Plaza Venture on 9 March 1989. Subsequent comments have been incorporated into this final report. The study was undertaken in accordance with our proposal dated 25 October 1988, and your subsequent authorization.

Accompanying this investigation was a site assessment relative to the Massachusetts Oil and Hazardous Material Release Act (MGL Chapter 21E). The results of that assessment were presented in our report entitled "Report on Oil and Hazardous Site Evaluation, One Lincoln Street Development, Boston, Massachusetts," dated 7 March 1988.

Prior to the present study, Haley & Aldrich, Inc. conducted a preliminary geotechnical evaluation on the construction feasibility of the proposed development based on readily available subsurface information in our files. The results of that study were presented in our report to Jung/Brannen Associates, Inc., dated 6 May 1988.

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Based on the results of subsurface explorations conducted and architectural-structural project information available at this time, it is recommended that the foundation for the proposed One Lincoln Street Development be designed as follows:

- The proposed building with five below-grade parking levels may be supported on reinforced concrete footings bearing on the dense to very dense glacio-marine silt and/or glacial till deposits. The lowest basement floor may be designed as an earth supported slab-on-grade with an underdrain system.

- The perimeter of the foundation excavation along the existing Bedford Building may be supported by a tangent-pile wall constructed by conventional drilled shaft installation procedures. Alternatively, the excavation may be supported by a concrete diaphragm wall constructed by slurry-trench technique. Both systems may be braced externally by tiebacks.

- Support the remaining larger portion of the perimeter of the foundation excavation by a system of soldier piles and wood lagging using conventional drilled shaft installation procedures and braced externally by tiebacks.

Results of subsurface explorations are presented in Section III of the report. Detailed foundation design recommendations for the proposed building are included in Section IV. Construction considerations are summarized in Section V.

We have appreciated and enjoyed the opportunity to undertake these geotechnical investigations and look forward to our

continued association with the project. If you have any questions, or require additional information, please do not hesitate to contact us.

Sincerely yours,
HALEY & ALDRICH, INC.

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I. INTRODUCTION

1-01. GENERAL

This report presents the results of recent subsurface explorations and presents foundation design criteria and construction recommendations for the proposed One Lincoln Street Development project in Boston, Massachusetts.

The proposed site, located as shown on Figure 1, "Project Locus", is bordered by Kingston, Bedford, Lincoln and Essex Streets, in the city of Boston. Currently, the site is occupied by several structures including the 10-story Bedford Mechanical Garage, two 5-story buildings and two paved, open parking lots.

The proposed project is planned to consist of a single building having a 35 to 38-story office tower located in the southeast portion of the site. Low-rise portions of 6 to 10 stories are planned for the remainder of the site area. Five levels of below-grade parking are planned beneath both the low and high-rise portions of the building. For the purpose of this study, it is assumed that the project will occupy the entire site and all existing on-site structures will be demolished to allow for the new development.

The project is being developed by Metropolitan/Columbia Plaza Venture. Our work has been coordinated with Jung/Brannen Associates, Inc., (J/B) project architect, and Weidlinger Associates, Inc., (WA) project structural engineer.

1-02. PURPOSE AND SCOPE

The purpose of the study was to evaluate subsurface conditions at the site and to develop foundation design criteria and construction recommendations. The scope of our investigations was as follows:

- o Accumulate readily available data on subsurface soil and rock conditions and groundwater levels near the project site.

- Gather readily available information on foundations of existing buildings within the site limits and those nearby.

- Develop and undertake a program of subsurface explorations to obtain soil, rock and groundwater information at the project site. In addition to the geotechnical requirements, subsurface explorations were also to meet the needs of the Chapter 21E site assessment.

- Expose, observe and document the type, geometry and physical conditions of the foundation of the existing five-story building at 99 Bedford Street (The Bedford Building).

- Conduct engineering evaluations and develop foundation design and construction recommendations.

1-03. AVAILABLE INFORMATION

The following information pertinent to the project site and the proposed development was provided to us during the course of our investigations:

A. Site plan entitled "Topographic Plan of Land, Boston, Massachusetts", by Survey Engineers of Boston, dated 25 August 1988; Drawing No. 255.02L.

B. Architectural plans entitled "Kingston/Bedford Development Plan", by Jung/Brannen Associates, Inc., dated 6 January 1989; Drawing Nos. 4,12-14,16,19-27. Finished floor elevations shown on these drawings are referenced to a particular project datum. It is our understanding that adding 24.5 ft. to the proposed floor elevations on these plans corresponds to elevations relative to Boston City Base (B.C.B) datum.

C. Preliminary foundation plans and the anticipated range of column loads for both steel and concrete framing schemes, from Weidlinger Associates. This preliminary information was presented on two foundation plans, one for each framing scheme as follows:

   - Concrete framing scheme; entitled "Foundation Level", drawing CS-1, dated 2 December 1988, scale 1 in.= 20 ft.

- o Steel framing scheme; entitled "Foundation Level", drawing S-1, dated 7 November 1988, scale 1 in. = 20 ft.

D. Site utility plan entitled "Utility Plan of Land, Boston, Massachusetts", by Survey Engineers of Boston, dated 25 August 1988; Drawing No. 255.03L.

1-04. SITE LOCATION AND CONDITIONS

The proposed site, located as shown on Figure 2, "Site and Subsurface Exploration Plan", is bordered by Kingston, Bedford, Lincoln and Essex Streets, in Boston, Massachusetts. Columbia Street runs in a north-south direction across the site.

The site is part of the original Boston peninsula and is located in the southwest section of an area formerly known as the Southern Cove. Much of the area was originally marshland. Early development of the site in the 1600's consisted mainly of residential structures along the higher elevation portion of the site along Bedford Street. Site filling began in 1722 and continued into the early 1800's with the lot remained as open fields and gardens during much of this period. During the second half of the 1800's, private houses constructed on the site gave way to businesses as the area became the center of the City's shoe and leather trade, in the form of wholesale dealers and selling of shoes that were produced in factories outside the City.

By the late 1800's numerous buildings ranged from approximately three to six stories were constructed on the site. The buildings were used primarily as office space, store frontage, machine shops and wholesale business to include shoes and leather goods.

Currently, the site is occupied by several structures including the five to 10-story Bedford Street Mechanical Parking Garage, two five-story brick buildings at No. 84 and Nos. 88-100 Kingston Street. The remainder of the site consists of two asphalt paved, open parking lots as shown on Figure 2.

Immediately adjacent the site is a five-story historical brownstone at 99 Bedford Street (The Bedford Building), which was built in 1876.

Records in the Boston Building Department and the Boston City Library (plan room) were researched in an attempt to locate foundation information of the above noted existing structures, but no such information was found. However, visits to these buildings revealed that the existing structures have only one basement level below-grade. Records were available to indicate that a 10-story parking garage once occupied the parking lot south of the Bedford Building, with two basement levels below-grade.

In addition, it is important to note that a site visit to the Bedford Building established that a below-grade vault exists under the sidewalk along the Columbia Street side of the building. The vault is apparently an extension of the basement of the Bedford Building approximately to the curbline of Columbia Street and is about 5 ft. wide. Access to the vault is provided by a number of doors in the basement of the building. Various utilities for the building were observed within the vault.

Site topography exhibits approximately 10 ft. of grade difference proceeding from north to south across the site. Ground surface ranges from approximately El. 25 to 29 along Bedford Street to about El. 19 along Essex Street. Ground surface elevations shown on Figure 2 and referred to in this report are referenced to Boston City Base (B.C.B.) elevation datum.

Other major below-grade structures adjacent to the site include the following (Refer to Figures 2,3 and 4):

- 99 Summer Street Building is a 20-story, granite faced building with two basement levels below grade. The top of the lowest floor slab is at approximately El. 4. The building is founded on spread footings bearing on the glacial till deposits at approximately El. 1 to 5 along the Bedford Street side of the building.

- Boston Edison Facility is a multi-story steel-framed electric substation along Kingston Street with one basement. The top of the lowest floor slab is at approximately El. 13. The building is supported by caissons bearing on the glacial till at approximately El. -20.

- The John F. Fitzgerald Expressway Tunnel is located at the southeast corner of the site directly beneath the Surface Artery, approximately 8 to 10 ft. from the project site boundary. The tunnel invert is at approximately El. -3 where closest to the site. The bottom of the soil-supported tunnel (bearing on the marine clay) is at approximately El. -8 in this area.

- A major telephone duct is believed to be located between the Expressway tunnel and the proposed structure. In fact, as shown on the site utility plan (referenced in Section 1-03.D) the duct is shown to extend several feet into the proposed project footprint. Record drawings indicate that the duct is approximately 42 in. wide, 10 ft. in height, and is 15 ft. below ground surface. The duct is reported to house 120, 4-in. diameter pipes (containing fiber optic cables) encased with approximately 4 in. of concrete cover all around. The actual location of the duct will have to be verified prior to construction.

- A 48-in. diameter sewer is located adjacent to the telephone duct. The reinforced concrete sewer invert is at approximately El. 5 where nearest the site as the sewer passes between the site boundary and the Expressway tunnel.

- 125 Summer Street Building is a 23-story building having five levels of below-grade parking. This building is currently under construction. Lowest floor level is at El. -21.0. The building was constructed by the "up-down" construction technique. The foundation walls are cast-in-place concrete diaphragm walls which are continuous along Lincoln Street and extend to bedrock, at approximately El. -45.

- Numerous other utilities are present directly below the streets bordering the site and adjacent to the existing Expressway tunnel that will require support during construction. In addition, utilities located within Columbia Street will have to be relocated or abandoned.

1-05. PROPOSED DEVELOPMENT

The proposed development will consist of a single building with a 35 or 38-story tower (depending on the structural framing scheme) to be located in the southeast portion of the site. A low-rise structure of 6 to 10 stories is planned for the

remainder of the site area. The final framing scheme, steel or concrete, has not been determined at this time. The mechanical floor and cooling tower will extend above the top floor reaching a total height of approximately 508 ft. We understand that the total height of the building would remain the same regardless of the framing scheme selected. Five levels of below-grade parking is planned under both low and high-rise portions of the building.

The project will occupy the entire site with the exception of about half of the width of Columbia Street along the Bedford Building. All the on-site structures will be demolished to allow for the new development.

Preliminary information provided by WA indicates that both steel and concrete structural framing schemes will have columns spaced typically 30 ft. apart around the building perimeter and low-rise areas, and 15 to 30 ft. apart within the high-rise portion of the building. The five basements will be constructed of reinforced concrete walls and floor slabs. The lowest level floor slab, approximately at El. -32, extends to a depth of about 60 ft. along Bedford Street and 50 ft. along Essex Street below the present site grades.

Preliminary column loading (total LL and DL) information provided by WA is summarized below:

	Low-Rise (tons)	Tower (tons)
Concrete Frame:		
Typical Exterior Column	1200	3100
Typical Interior Column	1750	4700-5600
Steel Frame:		
Typical Exterior Column	975	1400
Typical Interior Column	1250	3200

II. FIELD AND LABORATORY INVESTIGATIONS

2-01. TEST BORINGS

Prior to the present study, Haley & Aldrich, Inc., (H&A) conducted a preliminary geotechnical study for the proposed development based on readily-available subsurface information. The results of that study were presented in a report to Jung/Brannen Associates, Inc., entitled "Report on Preliminary Geotechnical Evaluation, Proposed Kingston/Bedford Development, Boston, Massachusetts," dated 6 May 1988. The previous test boring information in the vicinity of the proposed site was contained therein.

Ten test borings, designated B101 through B110, were drilled at the site by Geo Logic, Inc., Watertown, Massachusetts, during the period 14 December 1988 to 13 January 1989. The purpose of these borings was to obtain information on soil composition and density, stratum thickness, and depths to groundwater and bedrock, as required for foundation design. The test borings were also planned to meet the needs of the oil and hazardous material site assessment (Chapter 21E) which was undertaken concurrently for the proposed development. All borings were monitored by an H&A geologist. Boring logs prepared by Geo Logic and reviewed by H&A are included in Appendix A.

All borings were advanced by washing and utilizing a 4.0-in. I.D. casing to depths ranging from 66 to 92 ft. below the present ground surface. Standard split-spoon soil samples (ASTM D1586) were obtained at intervals generally not exceeding 5 ft., except continuous samples were taken through the existing fill soils at selected boring locations as required for the Chapter 21E site assessment.

Groundwater observation wells (2-in. diameter) were installed in completed borings B101, B102, B104, B107 and B108 for the purpose of monitoring groundwater levels, and for groundwater sampling within the scope of the Chapter 21E study. Observation well installation and groundwater monitoring reports are included in Appendix B.

Locations of test borings as shown on Figure 2 were determined by H&A, by taping from existing building corners. Ground surface elevations at test boring locations were estimated from

nearby spot elevations provided on the Survey Engineers of Boston site plan.

2-02. TEST PIT EXCAVATIONS

Two test pits were excavated by Crossroads Construction Inc. on 7 January 1989 under the supervision of the H&A project engineer. As shown on Figure 2, the test pits (TP1 and TP2) were excavated in the existing parking lot managed by Allright Boston Parking, Inc. The purpose of the test pits was to observe and document the type, geometry, bearing level and physical condition of foundations supporting the Bedford Building, which must be protected during the proposed construction. It was originally planned that one test pit on the west and the other on the south side of the Bedford Building would be excavated adjacent to the proposed development. However, as previously discussed, a below-grade vault beneath the sidewalk prevented excavation of a test pit along the Columbia Street side of the building.

The test pit log for TP1 prepared by H&A, along with photographs taken following completion of the test pit, are included in Appendix C. Because of the limited information obtained at TP2, a log was not prepared for this test pit. Discussion of observations made in both test pits is provided in Section 3-04 of this report.

2-03. LABORATORY TESTING

A laboratory soil testing program consisting of grain size distribution analyses and natural water content tests were conducted on selected soil samples obtained from the test borings. The test data have provided general information on classification of the soils encountered at the site.

Water content and grain size distribution tests were performed in accordance with ASTM D2215 and ASTM D422, respectively. Laboratory test results are included in Appendix D.

III. SUBSURFACE CONDITIONS

3-01. GENERAL

Subsurface soil and rock strata encountered at the site, as indicated by the referenced test borings, are listed below in order of increasing depth below ground surface:

- Miscellaneous Fill
- Marine Clay
- Glacio-Marine Silt
- Glacial Till
- Decomposed Argillite (Bedrock)

The above sequence reflects the general order of occurrence of the units below ground surface. However, one or more strata may not be present at a particular location. Specific descriptions of soil samples recovered in the test borings are provided in the boring logs included in Appendix A. A summary of subsurface conditions encountered at the locations of test borings is presented in Table I.

3-02. SUBSURFACE STRATA

The subsurface soils and rock underlying the site reflect the successive effects of glaciation, a subsequent estuarine marine environment, and various phases of man-placed filling. Generalized descriptions of the various strata encountered are given below.

- Miscellaneous Fill: Fill was encountered in all explorations, ranging from 7.5 to 18.5 ft. in thickness. The fill consists of loose to dense, brown to gray, coarse to fine sand with varying amounts of gravel, silt, clay, bricks, cinders, and other building rubble. Granite blocks and reinforced concrete remnants of old foundations were encountered in the fill at several boring locations.

- Marine Clay: This stratum consists of yellow-brown to gray, silty clay, with frequent partings and lenses of fine sand. Several borings (B103, B104, B106 and B108) encountered interbedded layers of silty fine sand to fine sand, up to 2.5 ft. in thickness. The clay stratum ranges

in thickness from about 12 to 37 ft. The upper 10 to 12 ft. has a hard to stiff consistency due to dessication and oxidation, becoming medium stiff with increasing depth. As indicated by the borings, the clay stratum is thinner along Bedford Street and increases in thickness rather uniformly proceeding south to Essex Street.

- Glacio-Marine Silt: A glacial till-like stratum of glacio-marine soil variable in composition was encountered underlying the marine clay at seven of the ten test boring locations. Relatively higher silt-clay content, lower blow counts "N" and lack of interparticle bonding distinguish this material from the underlying glacial till.

  The glacio-marine deposit ranges from about 7 to 29 ft. in thickness at the boring locations when encountered and consists of gray, dense to very dense clayey silt with some to little fine sand, or fine sandy silt with some clay. The top of the glacio-marine soils was encountered at elevations ranging from approximately El. 3 (B101) to El. -26 (B107).

- Glacial Till: A very dense, heterogeneous glacial deposit referred to as glacial till was encountered in all test borings. The glacial till stratum ranges in thickness from about 6 to 31 ft. or greater (where borings terminated in the till) at the boring locations. The till consists of gray to brown silty medium to fine sand to fine sandy silt, some to trace gravel, coarse to fine sand and clay. The elevation at which the top of this stratum was encountered varied from approximately El. -19 (B108 and B109) to El. -46 (B107).

  Glacial till encountered was typically very dense, with blow counts "N" generally in excess of 50 blows per foot, and was observed to be well bonded.

  Bedrock: Six of the ten test borings were advanced to bedrock which was encountered at depths from about 68 to 78 ft. at the boring locations. The top of the rock ranged in elevation from El. -41 (B101) to El. -56 (B105). Five to 15 ft. of bedrock was cored at five boring locations.

  The bedrock is known locally as the Cambridge Argillite. Close examination of the rock samples in the laboratory

indicated that the top of the bedrock had been subjected to some degree of hydrothermal alteration. This process is relatively common throughout the Boston Basin and results in a zone of softer bedrock than the underlying intact bedrock. Apparent hydrothermal alteration of the bedrock was observed at B102, B104, B105 and B107.

A majority of the rock was slightly to completely weathered, except at B110, where slight to moderate weathering was observed. The "continuity" of the rock core, which is a description of natural fractures in the rock, is classified as extremely to moderately fractured at all test boring locations (fractures at every 1 to 4 inches of core length). Rock quality as measured by RQD (Rock Quality Designation) was estimated to range from 0 to 26 percent indicating a very poor to poor rock quality.

3-03. GROUNDWATER LEVELS

Groundwater levels measured through the five observation wells installed at the project site are included in Appendix B. Stabilized groundwater levels measured in the wells during the period of investigation (14 December 1988 to 13 January 1989) and water levels measured in completed boreholes are given in Table 1.

Groundwater levels measured in observation wells indicate stabilized water levels at depths of about 13 to 22 ft. below the present ground surface, corresponding to elevations ranging from El. 4.9 at B101(OW) to El. 10.3 at B108(OW).

Typically, groundwater level was observed within the fill stratum or close to the fill/marine clay interface.

It should be noted that groundwater levels may fluctuate with precipitation, season, temperature, and may be influenced by adjacent structure foundation systems or drainage into existing sewer or storm drain systems. Consequently, water levels observed during construction may vary from those observed during the exploration program.

3-04. TEST PITS

Two test pits were excavated along the south foundation wall of the existing Bedford Building (99 Bedford Street) to observe pertinent features and the general physical condition of the foundations. Test pits encountered the following conditions:

- Test Pit No. 1: The pit was excavated at the southwest corner of the existing building (see Figure 2). Conditions observed in TP1 are documented on Figure C-1, Appendix C. As depicted in the figure, remnants of the foundation wall and the partially demolished first level floor slab (top El. 18.5) belonging to the demolished 10-story parking garage were identified. It appears that during demolition the below-grade foundation walls, floor slab and the buildings foundation units were left partially or completely intact. It is anticipated that the garage foundation consisted of footings bearing on the clay or caissons bearing on the glacial till and/or glacio-marine silt.

  As shown in the photographs provided in Appendix C, the fill consisted mainly of building rubble (reinforced concrete) mixed with granular soil. Also, large void spaces were observed within the fill.

  Although the lowest level floor slab of the demolished garage could not be reached in TP1, it is believed the top of slab is at approximately El. 9. Test boring B109 encountered 6-in. of concrete at this elevation. Large pieces of reinforced concrete and a maze of twisted reinforcing steel prevented further excavation.

  It is expected that the foundations for the Bedford Building are probably consisted of granite blocks bearing on the top of the marine clay stratum at approximately El. 13.5, as determined from nearby test boring B105. It is also anticipated that during the construction of foundations for the more recent, adjacent 10-story garage which extended below the foundation level of the Bedford Building, some form of underpinning was undertaken to secure the Bedford Building foundations.

- Test Pit No. 2: TP2 was excavated to the top of the partially demolished first level slab (El. 18.5) of the

garage structure. Observations made were quite similar to those at TP1. Because of difficulty in backfilling TP1 due to the presence of large void spaces and insufficient quantity of backfill material, TP2 was excavated to minimum dimensions allowing limited observations.

IV. FOUNDATION ENGINEERING EVALUATION AND DESIGN RECOMMENDATIONS

4-01. FOUNDATION SYSTEM

Based on the proposed building geometry, loading conditions, basement levels, and other design requirements, it is recommended that the proposed structure be supported on reinforced concrete footings bearing at shallow depths below the lowest basement level. The subgrade soil directly beneath the lowest level slab (approximately El. -32) consists of glacial till over a large portion of the building footprint. However, the glacio-marine silt is present at subgrade level in the general area of test borings B103, B107 and B110. Both soil deposits are suitable for direct support of footing foundations.

It is recommended that a maximum design bearing pressure of 15 tons per sq.ft. (tsf) be used in proportioning the footings bearing on the undisturbed glacial till and/or glacio-marine silt.

It should be noted that the recommended maximum design bearing pressure is greater than the presumptive value currently allowed by the Massachusetts State Building Code (Table 720). The recommended higher design value was determined based on the recent H&A experience with the results of in-situ Menard pressure-meter tests conducted within the glacial till soils underlying the 125 Summer Street project across Lincoln Street. In addition, the results of the in-situ pressure-meter tests conducted in the glacial till at the sites of the 125 High Street, the Rowes Wharf and International Place projects, all a few blocks away from the project site, were utilized in making this recommendation.

An approval from the Building Official to use the recommended value may be required.

If, during foundation excavation, relatively soft, local zones of glacio-marine deposits are encountered at the design bearing level, these soils should be removed by overexcavation and back filled with lean concrete. The suitability of the foundation bearing soils should be monitored and determined by the Project Geotechnical Engineer.

4-02. SETTLEMENT

The settlement of columns and walls supported on footings bearing on the undisturbed, dense glacial till and/or glacio-marine silt at the proposed design grade (approximately El. -35) will result primarily from elastic deformations of the foundation/soil system. It is expected that most of the settlement will occur during construction as the loads are applied. It is expected that no significant post-construction settlements will occur.

Total settlement of the foundation units for the dead plus live column loads estimated by WA is estimated to range from 1/2 to 1-1/2 inch in proportion to the magnitude of the loads. Differential settlements between heavily loaded interior columns and lightly loaded perimeter columns are estimated to be between 1/4 and 3/4 inch.

4-03. MODULUS OF SUBGRADE REACTION

It is recommended that a modulus of subgrade reaction of 650 tons per sq. ft. per ft. for the glacial till and glacio-marine silt be used in design of the foundation units. The stated modulus value is for a 1 ft. square rigid plate bearing at the proposed foundation grade. For actual foundation bearing areas the appropriate modulus should be calculated as follows:

$$K(s) = K(s,1)\ (m+0.5)/1.5m$$

where: m = L/B

L = Length of footing (ft)

B = Width of footing (ft)

K(s,1) = Modulus of subgrade reaction for a 1 ft. x 1 ft. plate; 650 tons per sq.ft. per ft.

K(s) = Modulus of subgrade reaction for a footing L x B in size.

For wall footings, a value of K(s) = 0.67 K(s,1) should be used. Wall footings should have a minimum width of 3 ft.

4-04. DESIGN GROUNDWATER LEVEL

As previously discussed in Section 4-03., water levels observed through observation wells installed at the site have ranged from approximately El. 5 to El. 10. Based on these data, a design water level of El. 12 is recommended for project design purposes.

4-05. LOWEST LEVEL FLOOR SLAB

Based on subsoil and groundwater conditions observed at the site, it is recommended that the lowest level floor slab be designed as a slab-on-grade with a permanent underdrainage system to relieve the hydrostatic uplift pressures.

Permanent relief of the hydrostatic pressures beneath the floor slab must take into consideration the potential adverse effects of lowered groundwater on adjacent structures and utilities. It is anticipated that the piezometric levels in the glacial till and glacio-marine silt underlying the foundation will be lowered to some degree by the permanent underdrain system. However, since these soils are quite incompressible, it will preclude any significant post-construction settlements caused by the drop in piezometric level. The groundwater levels in the fill and clay surrounding the project site should, however, be maintained as close to the preconstruction levels as possible, as lowered levels could have potential adverse effects on structures and utilities founded in the fill and the adjacent Bedford Building and Expressway tunnel which bears directly on the marine clay.

Therefore, as long as the water levels outside the site are maintained after foundation construction is complete, the lowest level floor slab can be designed as a slab-on-grade relieved by a permanent underslab drainage system, subject to the following considerations:

- o Hydraulic connection between the groundwater in the fill and clay and the underdrainage system must be minimized. To control potential vertical flow through the zone immediately adjacent to the foundation wall, it is recommended that a series of concrete "cutoffs" with bentonite seals be constructed as shown schematically on Figure 6. The lagging boards should be removed at the

"cutoff" areas prior to concrete placement. In addition, the vertical face of column and wall footings adjacent to the lateral support system should be cast directly against the in-situ glacial till/glacio-marine silt to further minimize groundwater inflow into the underdrain system.

- An underdrain system designed in accordance with Detail A on Figure 6 should be installed beneath the entire floor slab area.

- Since gravity discharge will not be possible, it is recommended that the underdrain system be designed to discharge the collected water to two or more sump pits equipped with automatic pumps. In addition, the system should be provided with an emergency power source and standby pumps. Clean-outs should be placed along the underdrain lines to facilitate maintenance. The pumps and the sump pits should be sized to accommodate a maximum flow of 50 gallons per minute. Normal flows rates are expected to be much less.

- Any pits or depressions below the lowest level basement slab, such as elevator pits, which extend below the underdrainage system should be designed to resist the hydrostatic pressure acting around and beneath the pit. In addition, to preclude the possibility of water seepage into the pits, the portions of the pits below the underdrainage system should be waterproofed and construction joints should be sealed with waterstops.

4-06. BASEMENT WALLS

A. Static Lateral Soil Pressures

Basement walls must be designed to resist lateral pressures due to a combination of soil, surcharge effects from adjacent structures such as the Bedford Building and other surface loadings, and hydrostatic forces. Recommended design static lateral loadings for the permanent foundation wall are shown on Figure 7. Effect of additional surcharge loading should be calculated on the basis of uniform lateral pressure equal to 0.5 times the vertical surcharge pressure acting on the backfill side and applied over a depth of 40 ft. below the surcharge load.

It should be noted that loadings provided on Figure 7 do not include specific surcharge loading which will be induced by the Bedford Building foundations, because, at the time of the preparation of this report, the type and geometry of the foundations as well as the foundation loads were not known.

B. <u>Waterproofing</u>

To help prevent minor seepage infiltration into the parking garage areas below the groundwater level, it is recommended that the joints in basement walls be sealed with waterstops. Also, appropriate waterproofing should be provided on the walls up to the design groundwater level, El. 12.

To efficiently and economically accommodate the lateral design loads imposed on the basement walls, the thickness of the foundation walls will increase with depth from ground surface. To provide for economical design, foundation walls are typically designed to have constant thickness in the span between floors with the increase in thickness made at the floor level. This increase thickness creates a "step" or shelf in the wall construction. It is recommended that the "stepped" side of the basement walls be constructed on the interior of the structure, leaving a flat, vertical surface on the exterior of the basement wall. This detail avoids ponding of groundwater on these steps and possible seepage through the wall.

4-07. <u>SEISMIC CONSIDERATIONS</u>

A. <u>Soil "S" Factor</u>

The soils below foundation bearing level qualify as a "Soil Site S1" in accordance with the Massachusetts State Building Code (Code) Section 720.5. Thus, an S-factor of 1.0 may be used in calculation of the base shear force in seismic design of the proposed building.

B. <u>Dynamic Lateral Earth Pressure</u>

During an earthquake occurrence, additional transient pressures will develop against the exterior basement

foundation walls of the structure due to the inertia effect of the surrounding soil strata. Since the basement walls are braced with the floor slabs, they are relatively rigid and non-yielding. This condition should be taken into account in determining the seismically induced component of the lateral earth pressure.

It is recommended that dynamic earth pressure component due to ground shaking should be considered as that provided on Figure 7.

C. <u>Liquefaction</u>

The Code provides criteria to evaluate the liquefaction potential of saturated, fine-grained cohesionless soils, based on Standard Penetration Resistance (Section 720.4) The term "liquefaction" describes a phenomenon in which a cohesionless soil experiences a substantial reduction in effective stress during an earthquake and acquires a degree of temporary mobility sufficient to permit substantial settlement and/or loss of bearing capacity. Based on our evaluation, it is concluded that the foundation bearing glacial till and glacio-marine soils are not susceptible to liquefaction.

V. CONSTRUCTION CONSIDERATIONS

5-01. GENERAL

The primary purpose of this Section is to comment on items related to excavation, dewatering, lateral earth support, foundation construction, earthwork and related geotechnical engineering aspects of the proposed construction. It is written primarily for the Engineer having responsibility for preparation of contract drawings and specifications. Since it identifies potential construction problems related to foundations and earthwork, it will also assist personnel who monitor the construction activity.

Prospective contractors for this project should evaluate potential construction problems on the basis of their own knowledge and experience with similar soil conditions in the Boston area, taking into account their own proposed construction methods.

In addition to the construction guidelines and recommendations made herein, foundation and lateral earth support construction should conform to the requirements of OSHA and all other applicable Municipal and State regulatory agencies.

5-02. GENERAL EXCAVATION

Based on the proposed building configuration, the foundation construction will require a major excavation to be made within the limits as shown of Figure 2. The excavation may extend within a few feet of the existing Bedford Building and curbline of adjacent streets. Assuming a general excavation bottom at El. -34, the excavation will extend approximately 62 ft. below Bedford Street and approximately 54 ft. below Essex Street. Locally, excavations will be deeper for footing and elevator pit excavations.

As previously noted, the project site is presently occupied by three buildings, which will be demolished, and paved parking lots, which were previously occupied by buildings. Therefore, it is expected that the remnants of basement floors, walls, and foundations, as well as abandoned utilities, will have to be removed as part of the general excavation. Such remnants of

existing buildings and general building rubble were encountered during the exploration program in all test borings, and in the test pits excavated along the south perimeter wall of the Bedford Building (see photographs in Appendix C).

It is expected that remnants of existing and previous building foundations will be limited to relatively shallow foundations bearing on the top of the marine clay. However, it is possible that the foundations for the larger 10-story parking garage that currently occupies a large portion of the site, and the 10-story parking garage previously located in the parking lot south of the Bedford Building, may have been founded on deep caissons bearing on the glacial till and/or glacio-marine silt underlying the marine clay. As previously mentioned, foundation information for these structures could not be located despite an intense research effort.

In addition to the existing building debris, tieback anchors from the lateral support system used in the construction of 99 Summer Street are known to exist along Bedford Street. Also, tieback anchors might also have been used during construction of the Expressway tunnel and may be encountered along portions of Essex Street.

It is expected that conventional earth moving equipment can be used for excavation of the soils at the site. However, based on our recent experience obtained during foundation excavation at 125 Summer Street, the glacial till and glacio-marine soils are very dense, and the till may contain large boulders. Hydraulic spades and other power equipment may be required for excavation of the till in confined areas where access of heavy machinery will be limited.

The subgrade soils are also relatively sensitive to erosion and disturbance. Accordingly, during the excavation and foundation construction operations, precautions must be taken to minimize disturbance to the bearing soils. The following guidelines are recommended:

- The final cuts to design bearing levels for foundations should be delayed as long as possible to minimize the time during which the subgrade surface are exposed. Alternatively, a lean concrete "mud mat" should be placed over the exposed subgrade at the footing locations to provide protection until footing concrete is placed. In

addition, disturbance due to movement of construction equipment directly over exposed subgrade bearing soils should be avoided.

- o The exposed subgrade soils must be examined in the field by the Geotechnical Engineer to observe the strength and bearing capacity of these soils. It may be necessary to require over-excavation and replacement of weak, disturbed, or otherwise unacceptable soils.

- o Any over-excavation of disturbed or unsuitable soils below design bearing grade must be backfilled with lean concrete.

5-03. LATERAL SUPPORT SYSTEM FOR FOUNDATION EXCAVATION

A. General

An excavation as deep as 62 ft. will be required for the construction of the proposed five basement levels. As shown on Figures 2, 3, 4 and 5, there are buildings, streets, sidewalks, utilities, in close proximity to the excavation on all sides of the site. In addition, support of the existing Bedford Building will require special attention during construction. The lateral earth support system, which will be designed by the Contractor, should be reviewed by a professional geotechnical engineer (P.E.) registered in the State of Massachusetts.

The conceptual lateral support schemes as shown on Figures 3 through 5.

B. Soldier Piles and Lagging

Except for the portion of the site adjacent the Bedford Building, it is recommended that the perimeter of the excavation be supported by a system of soldier piles and lagging, braced externally by tiebacks, which will be drilled and grouted into soils surrounding the excavation. Because of the significant depth of excavation and the inability to drive piles into the dense glacial till soils, it is recommended that the soldier piles be set in pre-drilled holes. Due to presence of water bearing interbedded sand lenses and layers in the marine clay stratum, the drilled holes may have to be cased through the fill and the clay strata. Alternatively, the holes may be

stabilized by slurry. The holes should be backfilled with a lean concrete mix after the soldier piles are set. If slurry is used in drilling the holes, concrete will have to be placed by the tremie technique.

It is further recommended that the tiebacks used for support of the lateral earth support system be of a type which are regroutable and minimize potential loss of the ground during installation. Due to the presence of fine to medium sand layers in the marine clay, cased drilling operations or hollow-stem augers should be utilized.

As shown on Figure 5, special support considerations will be required along the portion of the excavation adjacent the existing Expressway tunnel, located approximately 10 ft. from the site property line. The bottom the tunnel is at approximately El. -8 (i.e., about 28 ft. below ground surface). This condition will require the first level of tiebacks to be installed at approximately El. 0 or lower, requiring the upper portion of the soldier piles be designed as a cantilever. Since the amount of soil requiring retention between the existing Expressway tunnel and the excavation support system is relatively small, the lateral pressures will be comparatively lower than the typical pressures for that depth.

As previously mentioned, existing tiebacks from the adjacent 99 Summer Street construction are known to be located below Bedford Street. These tiebacks may interfere with the drilling for the soldier pile and/or tieback installation.

C. Lateral Support Along the Bedford Building

To preserve the integrity of the abutting Bedford Building, it is recommended that a more rigid temporary lateral support system, thus less deflection under the unbalanced earth and water pressure loads, be installed along the perimeter of the excavation adjacent to the Bedford Building. Such more rigid lateral support systems include concrete diaphragm walls installed with the slurry trench technique and tangent pile walls, both technically feasible for the particular project. The final selection should be made on the basis of relative cost and construction

scheduling. Main technical features of the two alternatives are summarized below.

1. Tangent Pile Wall

Tangent pile walls are installed using conventional drilled shaft installation procedures. Typically, they are composed of 2.5 to 3.0-ft. diameter caissons which overlap each other, providing a continuous concrete wall upon completion of excavation. As first order work, the primary piles are installed. These piles are drilled to the proposed tip elevation and then backfilled with unreinforced structural concrete. Prior to the concrete in the primary piles obtains its design strength, the secondary piles are drilled through the soil and partially into the primary piles to the design tip elevation. These secondary piles are reinforced for bending with structural steel. These piles are then backfilled with structural concrete, and tiebacks are installed for lateral support as the foundation excavation progresses.

In recent deep foundation excavations in Boston a modified approach has been implemented, which in effect, eliminates the primary pile installation. As shown on Figure 5, the reinforced piles are spaced approximately at 4.0 ft. on centers leaving a small area (approximately 1 ft.) of unsupported soil between two adjacent piles. If necessary, wood lagging or shotcrete is recommended for support of soil between the piles. Plywood is attached to the steel I-beams to provide a bond breaker for removal of excess concrete during excavation.

2. Slurry Wall Construction

A tied-back concrete diaphragm wall constructed by the slurry trench method (slurry wall) may be designed to provide lateral support during foundation excavation which would also serve as the permanent foundation wall. Some issues related to slurry wall construction and pertinent to the project requirements are as follows:

- A wall thickness of 30 in. is anticipated. A minimum of 24 in. is required for construction. Structural requirements will control the wall thickness.

- Near surface obstructions such as building rubble, old foundations and floor slabs should be removed prior to the start of wall construction by pretrenching.

- The wall surface is a direct reproduction of the soil surface against which the wall is cast. A loose boulder at the side of the trench removed during excavation will result in a protrusion on the surface of the wall. Occasional bumps and voids can be chipped off or filled as required. An example of a finished slurry wall for underground parking can be viewed at the 125 Summer Street project across Lincoln Street.

- As noted, the wall can be used for support of vertical loads. The excavation and final bottom elevation of the wall must be evaluated for capacity to carry such vertical loads.

It is important that the lateral support scheme selected is adequately designed by the Contractor to support the surcharge load imposed by the existing Bedford Building.

Prior to installation of the lateral support system adjacent the Bedford Building, we recommend the foundation system of the structure be investigated further. In order to adequately design the lateral support system for this building, it is essential to understand the current foundation system and the acting foundation loads. It will be important to determine the actual foundation type, bearing level, bearing soils and the physical condition of the foundation unit. It is recommended that additional test pits be excavated along the Bedford Building foundation walls adjacent to Columbia Street (west side) and the existing parking lot (south side) prior to construction, to observe and document existing conditions.

D. Support of Major Telephone Duct and 48-in. Diameter Sewer

As previously discussed, a major telephone duct and a 48-in. diameter sewer line are located along the existing Expressway tunnel at the southeast corner of the site. The site utility plan by Survey Engineers of Boston indicates that the duct extends several feet into the development property. Based on our experience at the adjacent 125 Summer Street project, it is likely that the relocation of this duct will not be feasible, therefore, the contractor should provide the necessary measures to protect the duct.

Due to the close proximity of the duct and the sewer line to the excavation, it is recommended that they be supported by the soldier pile and lagging system proposed for the site excavation, with additional brackets and/or beams supported by the soldier piles, as necessary.

Prior to installation of the lateral support system in this area, it is recommended that test pits be excavated to determine the actual location of both the telephone duct and the sewer line.

5-04. DEWATERING

The excavation will extend approximately 40 to 45 ft. below the presently observed groundwater levels at the site. The proposed soldier pile and lagging system will allow some seepage into the excavation. In addition, seepage could occur up from the bottom of the excavation. Since the glacial till and glacio-marine silt are relatively impervious, the total volume of inflow will depend on the extent of pervious zone within these soils and especially the marine clay above, which is interbedded with water bearing sand lenses and layers.

It is anticipated that open pumping methods can be used to handle water entering the excavation. The Contractor should be prepared to install a number of sump pits and drainage ditches with properly designed filters to keep the excavation free as possible of standing water on the subgrade soils to preserve their undisturbed strength.

5-05. CONSTRUCTION MONITORING

A. Preconstruction Surveys (By Owner)

It is recommended that preconstruction surveys of nearby structures, particularly the Bedford Building, be conducted prior to the start of construction. This will protect the Owner against possible claims of damage due to the proposed new construction. A preconstruction survey will document any visible signs of distress on existing structures, including cracks in building walls, floor slabs and sidewalks.

The demolition method for the existing 10-story Bedford Street Parking Garage is not known at this time. However, recently, demolition of larger structures within Boston have been by implosion. This demolition technique has proven successful many times in an urban environment (for example, Fort Hill Square Garage and The Travelers Building), however if selected as the method of demolition, we recommend the preconstruction survey been completed prior to the implosion.

Vibration monitoring during the implosion is also recommended to assess the maximum peak particle velocity of ground motion for correlation with claims for damage.

B. Geotechnical Instrumentation (By Owner)

Geotechnical instrumentation is recommended to confirm predictions of soil and structure behavior, monitor the Contractor's performance, provide early warning of problems, and aid assessments of the need for measures to mitigate unacceptable movements.

Recommended geotechnical instrumentation include the following:

- o Offset survey points and reference points to measure horizontal and vertical movements of all adjacent structures and major utilities including the telephone duct and the 48-in. diameter sewer;
- o Reference points to monitor settlement of the new structure;

- Reference points to monitor ground settlement behind the lateral support system;

- Inclinometers cast into the lateral support system to monitor horizontal wall deflections; offset survey points and reference points to measure horizontal and vertical movements of the lateral support system.

- Installation of additional observation wells and piezometers outside the site to monitor groundwater levels prior to, during, and after construction. This will provide information regarding the impacts of the construction activities on the groundwater levels outside the site limits and allow to take necessary measures to remedy any undesirable effects. In addition, this will allow monitoring of the effectiveness of the seepage cut-offs.

Specific details of the instrumentation program will need to be developed after the procedures and methods of excavation and existing building demolition have been established by the Contractor.

C. Field Monitoring During Construction (By H&A)

It has been agreed that Haley & Aldrich, Inc., will be retained to represent the Owner during foundation construction and be on-site to:

1. Observe and test, if necessary, the exposed soils at subgrade levels to confirm that in-situ conditions are consistent with those predicted for design, and to observe that the natural soils are not in some way disturbed by construction activities.

2. Observe the installation of the lateral support system, including documentation of the soil types which are encountered during soldier pile and tangent pile installation, or slurry wall installation (if used).

3. Monitor and document the installation and testing of tiebacks for the lateral earth support system.

4. Observe placement of crushed stone and the underdrain pipe system beneath the slab-on-grade.

5. Observe and test placement of compacted granular fill backfill, and perimeter groundwater cutoff system between the lateral support system and the permanent foundation wall.

6. Monitor the geotechnical instrumentation recommended above.

5-06. SPECIFICATION AND PLAN REVIEW

It is recommended that Haley & Aldrich be given an opportunity to review all final plans and specifications for the foundation system, earthwork, lateral support system, and related items to confirm that they are consistent with recommendations contained in this report.

5-07. OIL AND HAZARDOUS MATERIAL REVIEW

It is recommended that in addition to the Geotechnical Reports, the contractor review all oil and hazardous material site evaluation reports by Haley & Aldrich, Inc. A preliminary site assessment entitled "Report on Oil and Hazardous Site Evaluation, One Lincoln Street Development, Boston, Massachusetts", dated 7 March 1988, is currently available for review. Work is currently underway for a Phase II - Comprehensive Site Assessment including a risk assessment report for submission to the Massachusetts Department of Environmental Quality Engineering (DEQE). Additionally, the Massachusetts Contingency Plan (MCP) will require a Phase III - Development and Remedial Response Alternatives, and a Phase IV Final Remedial Response Plan, depending on the results of Phase II.

VI. CONCLUDING COMMENTS

This report has been prepared for specific application to the proposed One Lincoln Street Development project in Boston, Massachusetts, in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made. In the event that changes in the design or location of the proposed structures are proposed, the conclusions and recommendations contained in this report should be reviewed and modified or verified in writing. Our recommendations are based in part upon data obtained from the referenced subsurface explorations. The nature and extent of variations between the explorations may not become evident until construction. If variations then appear, it may become necessary to re-evaluate the recommendations of this report.

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Tables

TABLE I

SUMMARY OF TEST BORINGS
ONE LINCOLN STREET DEVELOPMENT
BOSTON, MASSACHUSETTS

BORING NUMBER	GROUND SURFACE ELEVATION (FT)	DEPTH OF BORING (FT)	BOTTOM ELEVATION OF BORING (FT)	GROUND-WATER ELEVATION (FT)	STRATA THICKNESS (FT)					TOP ELEVATION, FT. (B.C.B)			
					FILL	MARINE CLAY	GLACIO-MARINE	GLACIAL TILL	DECOMPOSED BEDROCK	MARINE CLAY	GLACIO-MARINE	GLACIAL TILL	BEDROCK
B101(OW)	26.5	65.2	-42.7	4.9	12.0	11.8	28.7	15.0	1.7*	14.5	2.7	-26.0	-41.0
B102(OW)	25.0	89.5	-64.5	9.4	17.0	12.5	19.5	25.0	15.1*	8.0	-4.5	-24.0	-49.0
B103	21.0	67.0	-46.0	14.5	9.5	32.0	22.0	3.5*	--	14.5	-20.5	-39.5	--
B104(OW)	19.5	85.0	-65.5	6.6	9.3	36.7	--	27.0	12.0*	10.2	--	-26.5	-53.5
B105	21.0	89.0	-68.0	1.0	7.5	30.5	8.5	31.0	11.5*	13.5	-17.0	-25.5	-56.5
B106	19.5	66.0	-46.5	-0.5	14.0	32.5	--	19.5*	--	5.5	--	-27.0	--
B107(OW)	21.5	92.0	-70.5	7.8	11.0	36.5	20.5	5.8	18.2*	10.5	-26.0	-46.5	-52.3
B108(OW)	23.0	66.0	-43.0	10.3	18.5	24.2	--	23.3*	--	4.5	--	-19.7	--
B109	24.0	68.9	-44.9	21.0	16.5	20.5	6.5	25.4*	--	7.5	-12.5	-19.5	--
B110	25.5	80.5	-55.0	6.5	18.0	20.0	25.0	10.0	7.5*	7.5	-13.5	-37.5	-47.5

NOTES:

1. ELEVATIONS ARE IN FEET AND REFER TO BOSTON CITY BASE.

2. -- INDICATES STRATUM NOT ENCOUNTERED WITHIN DEPTH OF BORING.

3. * INDICATES DEPTH OF PENETRATION INTO STRATUM.

4. (OW) INDICATES GROUNDWATER OBSERVATION WELL INSTALLED IN COMPLETED BOREHOLE.

5. GROUNDWATER ELEVATIONS REPORTED HEREIN ARE STABILIZED MEASUREMENTS IN THE RESPECTIVE OBSERVATION WELLS. FOR HOLES WITHOUT OBSERVATION WELLS, THE REPORTED ELEVATIONS WERE MEASURED AT THE COMPLETION OF THE BORINGS AND MAY NOT REPRESENT STABILIZED GROUNDWATER LEVEL. SEE APPENDIX B FOR GROUNDWATER OBSERVATION WELL INSTALLATION AND MONITORING REPORTS.

6. GROUND SURFACE ELEVATIONS AT TEST BORINGS WERE ESTIMATED FROM NEARBY SPOT ELEVATIONS SHOWN ON A PLAN ENTITLED "TOPOGRAPHIC PLAN OF LAND, BOSTON, MASSACHUSETTS", BY SURVEY ENGINEERS OF BOSTON, DATED 25 AUGUST 1988 (DRAWING NO. 255.02L).

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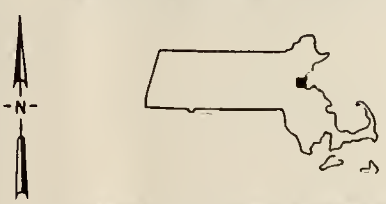
Figures

SITE COORDINATES: 42°21'09"N 71°03'31"W



U.S.G.S. QUADRANGLE: BOSTON SOUTH, MA

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

ONE LINCOLN STREET
BOSTON, MASSACHUSETTS

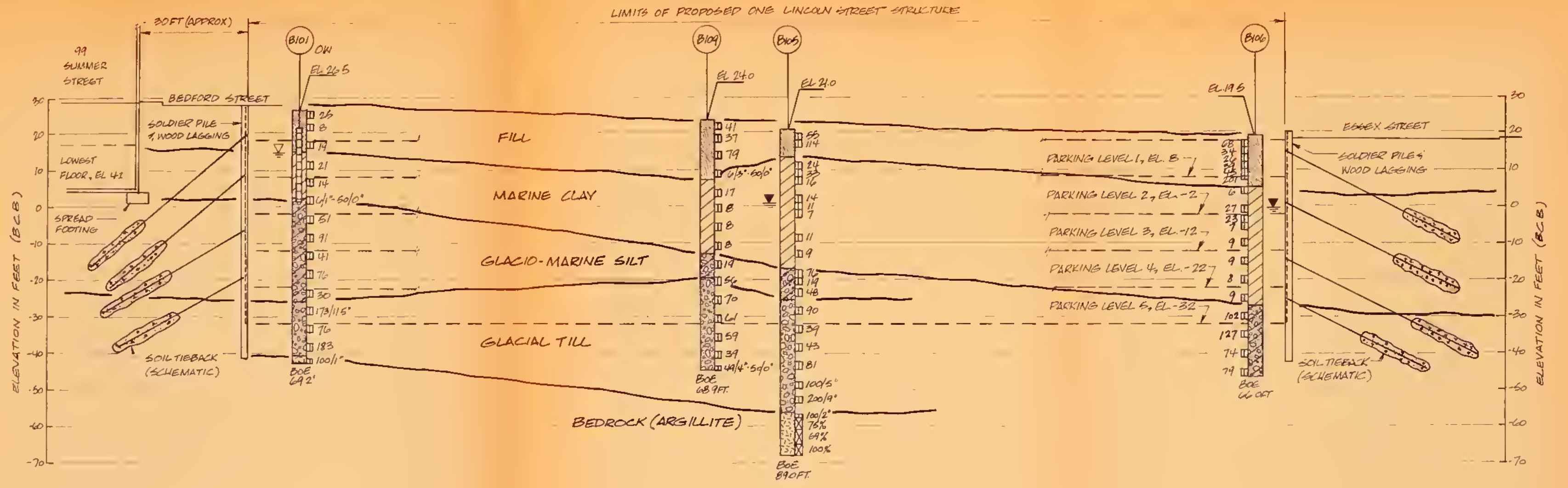
PROJECT LOCUS

APPROX. SCALE 1:25,000

FEBRUARY 1989

FILE NO. 06691-00 A1

FIGURE 1



LEGEND:

BORING NUMBER

"OW" INDICATES GROUNDWATER OBSERVATION WELL

GROUND SURFACE ELEVATION (BOSTON CITY BASE).

GROUNDWATER LEVEL MEASURED OVER TIME IN OBSERVATION WELL INSTALLED IN COMPLETED BOREHOLE

GROUNDWATER LEVEL OBSERVED UPON COMPLETION OF BOREHOLE.

OBSERVATION WELL INSTALLED IN COMPLETED BOREHOLE.

STRATIFICATION LINE BETWEEN SUBSURFACE UNITS.

SAMPLE OBTAINED BY 2-IN. O.D. SPLIT-SPOON SAMPLER DRIVEN WITH 140-LB. HAMMER FALLING FREELY THROUGH 30 IN. NUMBER INDICATES STANDARD PENETRATION RESISTANCE, N-VALUES, IN BLOWS PER FOOT OF PENETRATION

LOCATION OF NX ROCK CORE RUN. NUMBERS INDICATE PERCENT RECOVERY. LENGTH OF CORE RECOVERED DIVIDED BY LENGTH OF CORE RUN.

BOE 64.2' BOTTOM OF EXPLORATION.

NOTES:

1 REFER TO FIGURE 2 FOR SUBSURFACE PROFILE SHOWN ON THIS FIGURE

2 TEST BORINGS WERE DRILLED BY GEO-LOGIC, INC., WATERTOWN, MA, DURING THE PERIOD 14 DECEMBER 1988 THROUGH 13 JANUARY 1989, AND MONITORED BY HALEY & ALDRICH, INC

3 LINES REPRESENTING CHANGES IN STRATA ARE BASED UPON INTERPOLATION BETWEEN SUBSURFACE EXPLORATIONS, AND MAY NOT REPRESENT ACTUAL CONDITIONS

4 GROUND SURFACE ELEVATIONS AT TEST BORING LOCATIONS WERE MEASURED FROM NEARBY SPOT ELEVATIONS SHOWN ON A PLAN ENTITLED "TOPOGRAPHIC PLAN OF LAND, BOSTON, MASSACHUSETTS," BY SURVEY ENGINEERS OF BOSTON DATED 25 AUGUST 1988

5 ELEVATIONS REFER TO BOSTON CITY BASE (BCB) WHEREIN EL. 0.00 IS 5.65 FT BELOW NATIONAL GEODETIC VERTICAL DATUM (NGVD)

6 FOUNDATION INFORMATION OF EXISTING STRUCTURES ADJACENT TO THE PROJECT SITE AS SHOWN IS SCHEMATIC AND WAS OBTAINED FROM HALEY & ALDRICH FILES.

7 THE TEMPORARY EXCAVATION SUPPORT SCHEMES AS SHOWN ARE CONCEPTUAL ONLY. THE DESIGN OF THE LATERAL SUPPORT SYSTEMS SHALL BE PREPARED BY THE CONTRACTOR AND SUBMITTED TO THE DESIGN TEAM FOR REVIEW

0 20 40 HORIZ VERT
SCALE IN FEET

SOILS LEGEND:

SUBSURFACE UNIT	SYMBOL	DESCRIPTION
MISCELLANEOUS FILL		LOOSE TO VERY DENSE, BROWN TO GRAY, COARSE TO FINE SANDS WITH VARYING AMOUNTS OF GRAVEL, SILT, CLAY, BRICKS, CINDERS, AND OTHER BUILDING RUBBLE.
MARINE CLAY		HARD TO MEDIUM STIFF, YELLOW-BROWN TO GRAY SILTY CLAY WITH FREQUENT PARTINGS AND LAYERS OF FINE SAND.
GLACIO-MARINE SILT		DENSE, GRAY TO BROWN, CLAYEY SILT WITH SOME TO LITTLE FINE SAND OR FINE SANDY SILT WITH SOME CLAY (POORLY BONDED).
GLACIAL TILL		VERY DENSE, GRAY TO BROWN SILTY MEDIUM TO FINE SAND TO FINE SANDY SILT, SOME TO TRACE FINE GRAVEL AND CLAY (WELL-BONDED).
BEDROCK		VERY SOFT TO MODERATELY HARD, SLIGHTLY TO COMPLETELY WEATHERED, EXTREMELY TO MODERATELY FRACTURED, GRAY ARGILLITE.

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

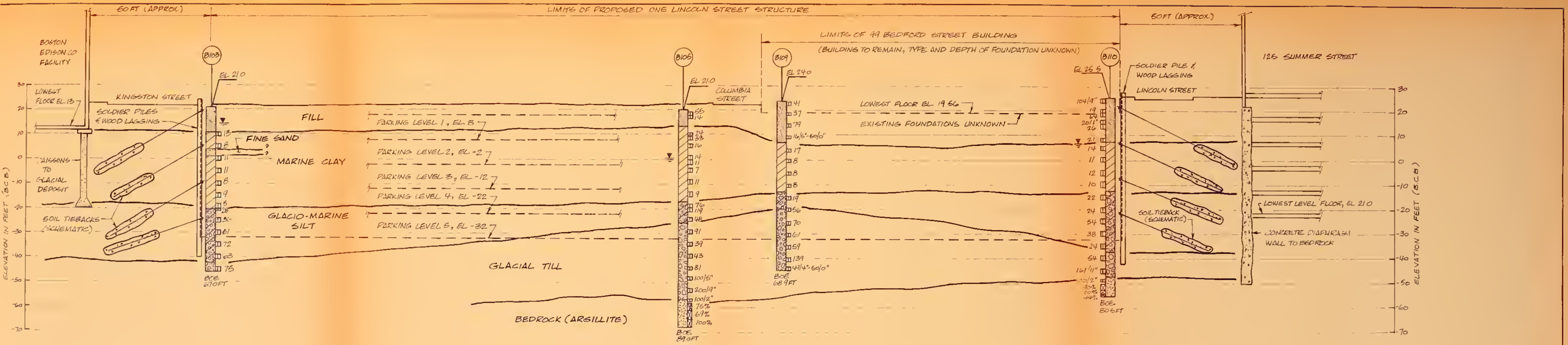
ONE LINCOLN STREET
BOSTON MASSACHUSETTS

SUBSURFACE PROFILE A-A
AND
CONCEPTUAL LATERAL SUPPORT SCHEME

SCALE AS SHOWN

MARCH 1989

FIGURE 3



NOTES.

1. REFER TO FIGURE 2 FOR LOCATION SUBSURFACE PROFILES

2. SEE FIGURE 3 FOR NOTES AND LEGEND.

0 20 40 HORIZ VERT
SCALE IN FEET

Haley & Aldrich, Inc.
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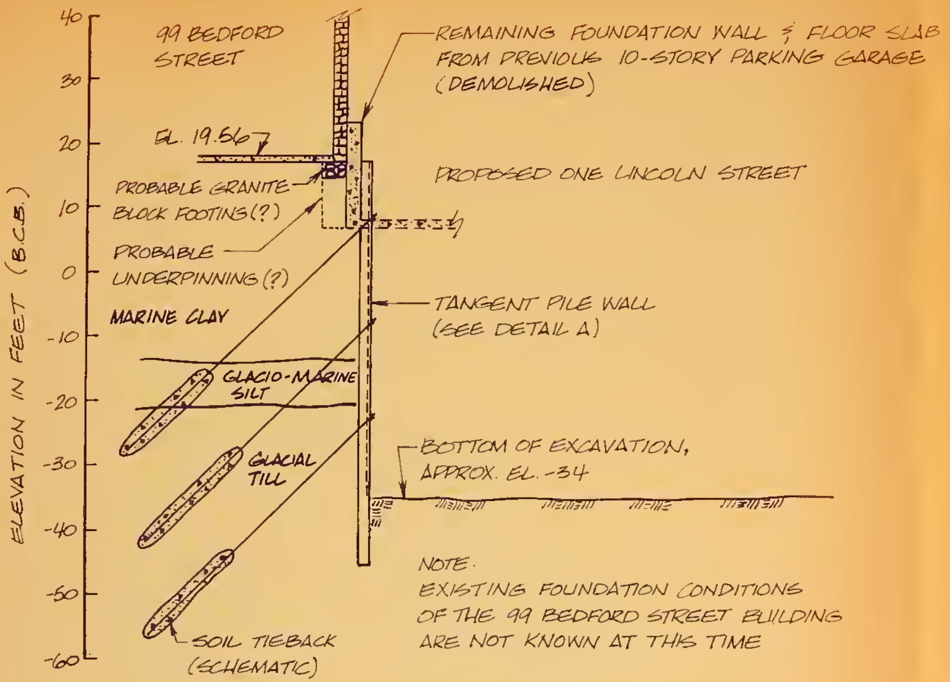
ONE LINCOLN STREET
BOSTON, MASSACHUSETTS

SUBSURFACE PROFILE B-B
AND
CONCEPTUAL LATERAL SUPPORT SCHEME

SCALE AS SHOWN

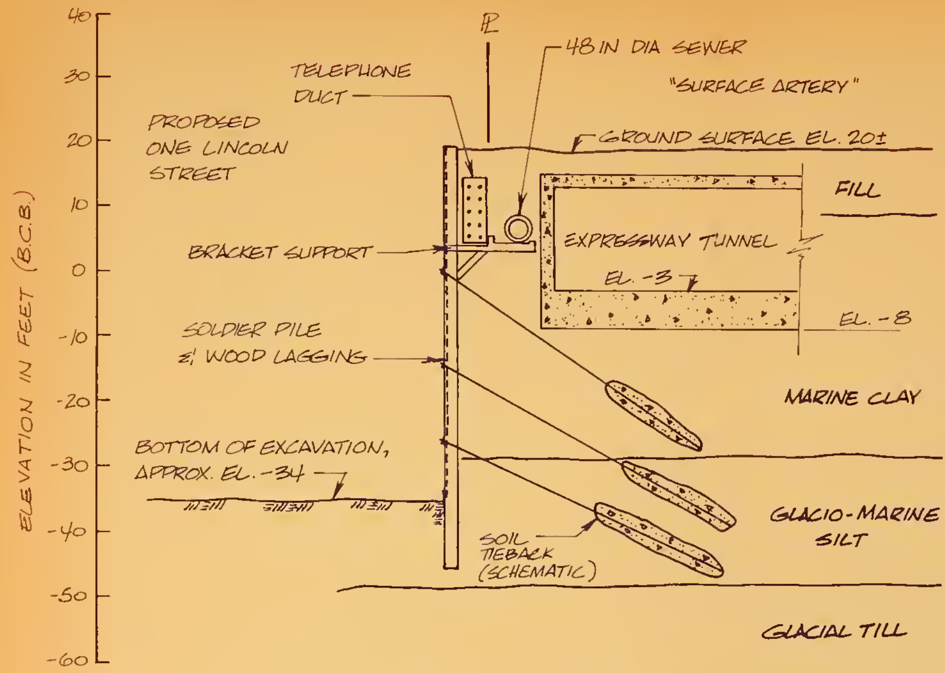
MARCH

FIGURE 4



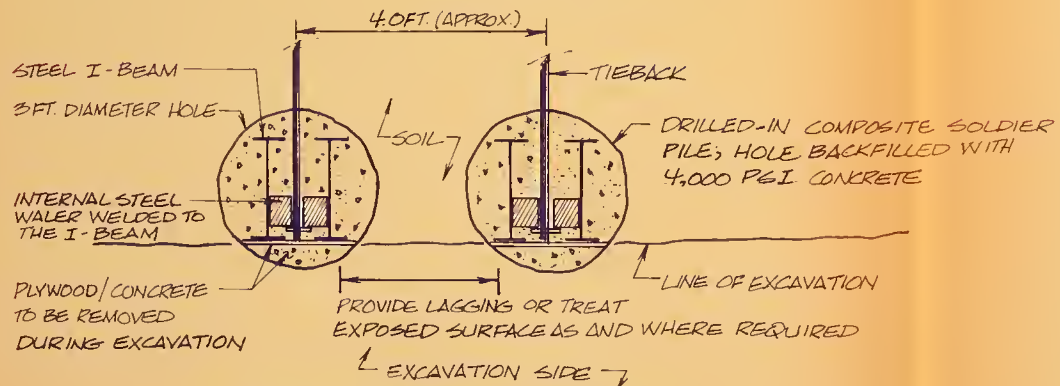
SUBSURFACE PROFILE C-C

SCALE: 1" = 20'



SUBSURFACE PROFILE D-D

SCALE: 1" = 20'



DETAIL A - TANGENT PILE WALL

NOT TO SCALE

NOTES:

1. REFER TO FIGURE 2 FOR LOCATION SUBSURFACE PROFILES.
2. SEE FIGURE 3 FOR NOTES AND LEGEND.
3. THE DIMENSIONS PROVIDED IN (DETAIL A - TANGENT PILE WALL) ARE FOR GENERAL CONSIDERATIONS ONLY. THE TANGENT PILE WALL SYSTEM FOR TEMPORARY LATERAL SUPPORT OF EXCAVATION WILL BE DESIGNED BY THE CONTRACTOR TAKING INTO ACCOUNT THE LATERAL PRESSURES ACTING DURING ALL PHASES OF FOUNDATION CONSTRUCTION.

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

ONE LINCOLN STREET
BOSTON, MASSACHUSETTS

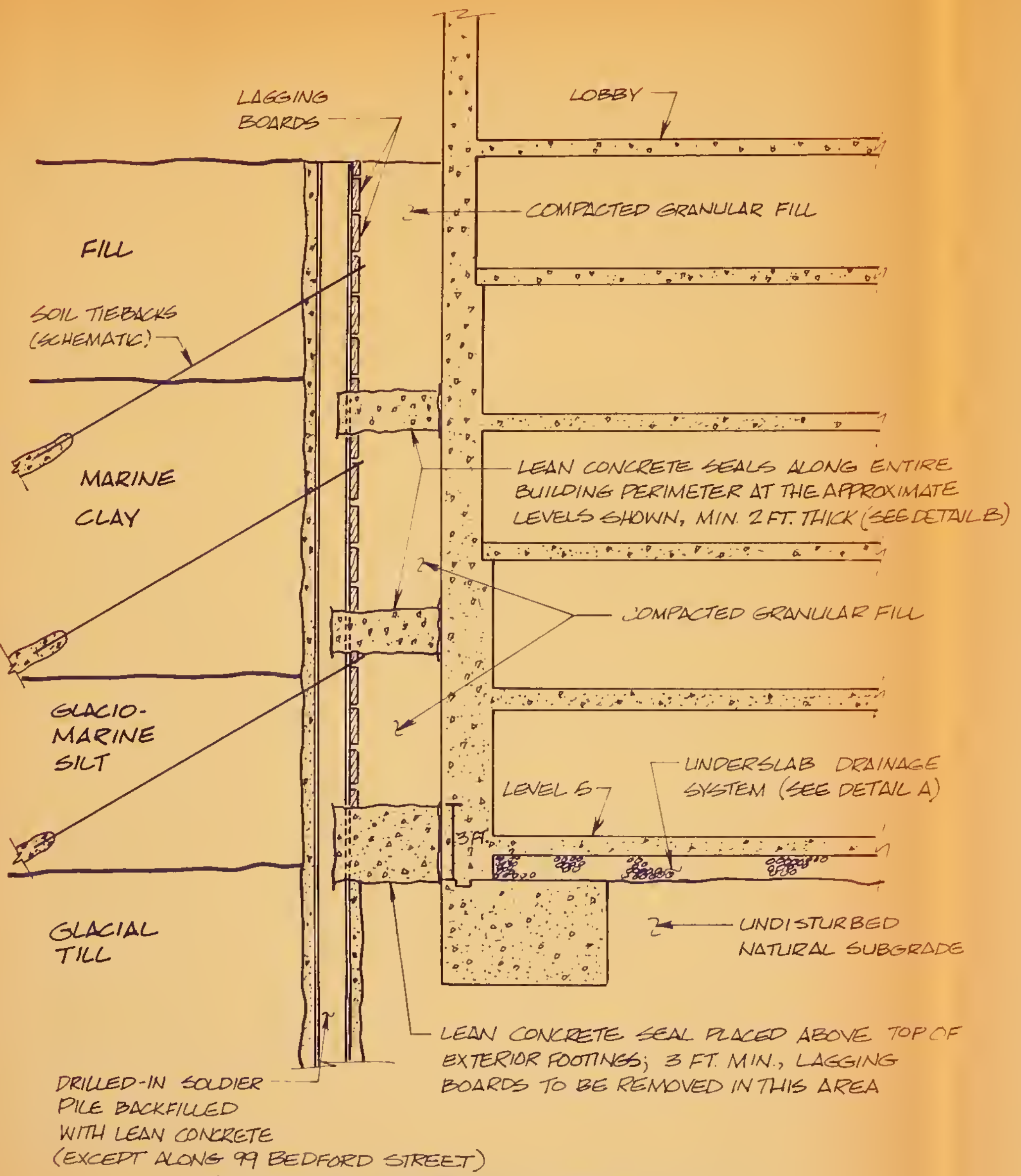
SUBSURFACE PROFILES C-C & D-D
AND
CONCEPTUAL LATERAL SUPPORT SCHEME

SCALE: AS SHOWN

MARCH 1989

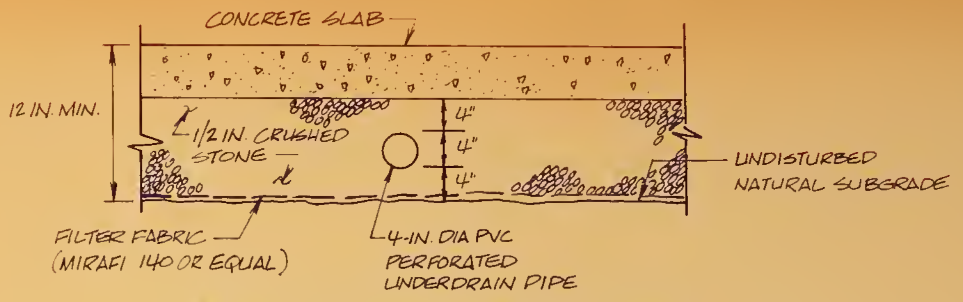
FIGURE 5

FILE NO. 06691-00 B5



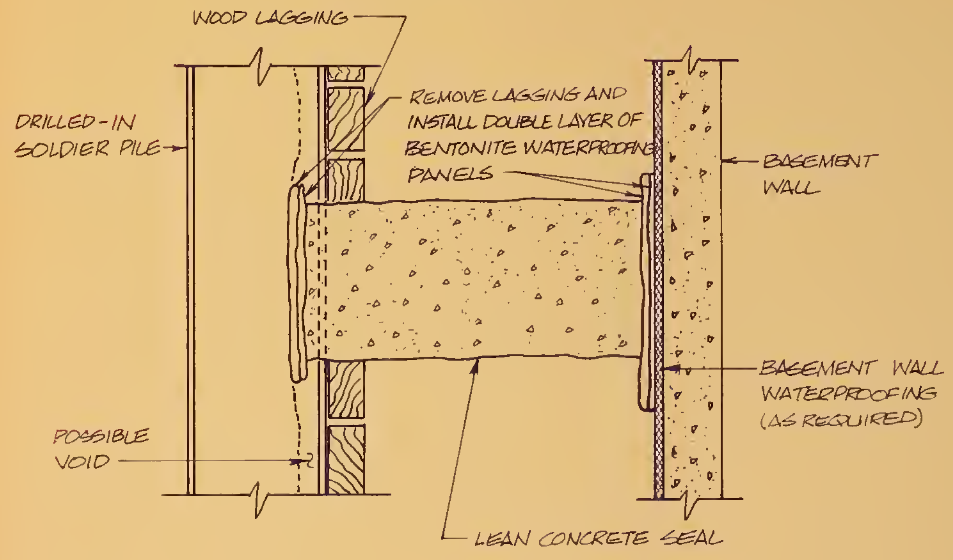
TYPICAL WALL SECTION - SCHEMATIC

(NOT TO SCALE)



DETAIL A - UNDERSLAB DRAINAGE

(NOT TO SCALE)



DETAIL B - CONCRETE SEAL

(NOT TO SCALE)

NOTE:

CONCRETE SEAL DETAIL TO BE REVIEWED AND REVISED BASED ON FIELD CONDITIONS ENCOUNTERED.

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

ONE LINCOLN STREET
BOSTON, MASSACHUSETTS

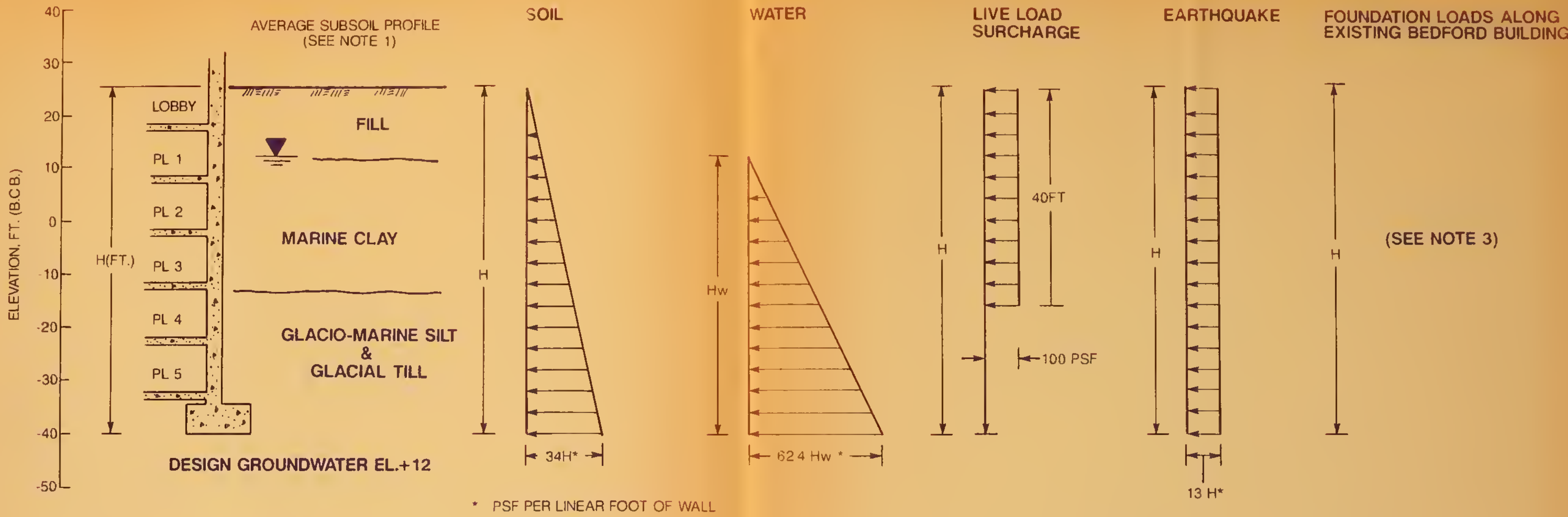
UNDERSLAB DRAIN
AND
PERIMETER CUTOFF TYPICAL SECTION

NOT TO SCALE

MARCH 1989

FIGURE 6

FILE NO. 06691-00 B6



NOTES:

1. THE RECOMMENDED SOIL PRESSURE DIAGRAMS WERE DEVELOPED FROM INFORMATION OBTAINED FROM SUBSURFACE EXPLORATIONS CONDUCTED IN THIS INVESTIGATION. THESE DIAGRAMS MUST BE REVIEWED AND REVISED, AS REQUIRED, IF CONDITIONS DIFFERENT FROM THOSE SHOWN ARE ENCOUNTERED DURING CONSTRUCTION.

2. SOIL PARAMETERS CONSIDERED TO DEVELOP THE LOADING DIAGRAMS ARE AS FOLLOWS:

SOIL STRATUM	TOTAL UNIT WEIGHT, (PCF)	ANGLE OF INTERNAL FRICTION,	UNDRAINED SHEAR STRENGTH Su (PCF)
FILL	130	35°	-
MARINE CLAY	120	-	1500
GLACIO-MARINE SILT	140	37°	-
GLACIAL TILL	140	37°	-

3. LATERAL PRESSURES THROUGH THE EXISTING BEDFORD BUILDING FOUNDATIONS COULD NOT BE INCLUDED IN THIS FIGURE. THIS IS BECAUSE TYPE, DEPTH, GEOMETRY OF THESE FOUNDATIONS AS WELL AS LOADS PRESENTLY ACTING ON THEM ARE NOT KNOWN AT THE TIME OF PREPARATION OF THIS REPORT. THESE LOADS AND THE RESPECTIVE LATERAL PRESSURES WHICH WILL BE INDUCED ON THE PROPOSED FOUNDATION WALLS MUST BE ACCOUNTED FOR IN THE FINAL DESIGN PHASE.

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

ONE LINCOLN STREET
BOSTON, MASSACHUSETTS

RECOMMENDED DESIGN LOADS
AGAINST FOUNDATION WALLS

SCALE: AS SHOWN

MARCH 1989

FILE NO. 0669 1-00 B9

CHARRETTE

FIGURE 7

Appendix A

APPENDIX A

Test Boring Logs

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT	Haley & Aldrich, Inc.
PROJECT	Bedford-Kingston Parcel
LOCATION	Boston, Mass.
Boring #	B-101
Page	1 - of - 3

	CASING	SAMPLER	CORE BARREL
TYPE	HW	SS	--
SIZE	4"	1 3/8"	--
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El: 26.5 (B.C.B.)
Station

Ground water

Date	Depth
1/11/89	20.7'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 1/9-1/11/89

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
		S1	0.5'-2.5'	24"	12"	10-17	0.5'	Blacktop
						8-6		S1 M-dense brown Gravel, f-m Sand, some Silt, trace Concrete
5'		S2	4'-6'	24"	9"	7-4		S2 M-stiff to stiff brown fine Sandy SILT, trace m-c Sand, Fill
						4-7		Concrete (6.0-7.8 ft.)
10'		S3	9'-11'	24"	6"'	4-6		S3 M-dense brown/grey f-m SAND, trace Silt, Wood Concrete - Fill
						13-9	12.0'	
15'		S4	14'-16'	24"	24"	WOR-8		S4 V-stiff yellow/brown Silty CLAY
						13-12		
20'		S5	19'-21'	24"	24"	5-5		S5 Stiff brown/grey Silty CLAY
						9-10	23.8'	
25'		S6	24'-24.6'	6"	5"	42-6/1"		S6 Hard grey SILT, little f-c Gravel, trace f-c Sand, Clay
						50/0"		Boulders 24.5'-25.1'
30'		S7	29'-31'	24"	11"	22-29		S7 Hard grey f-m Sandy SILT, trace coarse Sand, occasional seams of medium and fine Sand
						22-30		
		S8	34'-36'	24"	16"	54-42-49-47		S8 Hard grey SILT, trace f-c Gravel, f-c Sand, Clay

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC

EARTH EXPLORATION SERVICES

74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172

(617) 923-4420

CLIENT	Haley & Aldrich, Inc.	Boring #	B-101
PROJECT	Bedford-Kingston Parcel	Page	2 - of - 3
LOCATION	Boston, Mass.		

	CASING	SAMPLER	CORE BARREL
TYPE	HW	SS	--
SIZE	4"	1 3/8"	--
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El:

Station

Ground water

Date	Depth
1/11/89	20.7'

GLI File # 88240

Driller T. Paquette

Consultant W. Rubik

Date Start/Finish 1/9-1/11/89

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
40'		S9	39'-40'	24"	10"	18-16 25-26		S9 Hard grey SILT, trace fine Gravel, f-c Sand, Clay
45'		S10	44'-46'	24"	12"	26-30 46-61		S10 Hard grey SILT, little fine Sand, trace m-c Sand
50'		S11	49'-51'	24"	11"	12-15 15-15		S11 V-stiff to hard grey SILT, little fine Sand
							52.5'	
55'		S12	54'-55.5'	18"	13"	55-73 100/5.5"		S12 Hard grey SILT, little fine Sand, trace f-c Gravel, m-c Sand
60'		S13	59'-60'	24"	15"	31-28 48-64		S13 Hard grey SILT, trace f-c Sand
65'		S14	64'-65.5'	18"	12"	58-83 100		S14 Hard grey SILT, trace coarse Gravel, f-c Sand
							67.5'	Top of Bedrock at 67.5'
						100/1"		S15 Grey ARGILLITE
		S15	69'-69.2'	2"	0.5"	100/1"-300#	69.2'	Refusal at 69.2'-bottom of hole

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks: See Page 3 of 3 for well materials

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT	Haley & Aldrich, Inc.	Boring #	B-101
PROJECT	Bedford-Kingston Parcel	Page	1 - of - 3
LOCATION	Boston, Mass.		

	CASING	SAMPLER	CORE BARREL
TYPE	HW	SS	--
SIZE	4"	1 3/8"	--
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El: 26.5 (B.C.B.)
Station

Ground water

Date	Depth
1/11/89	20.7'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 1/9-1/11/89

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
		S1	0.5'-2.5'	24"	12"	10-17	0.5'	Blacktop
						8-6		S1 M-dense brown Gravel, f-m Sand, some Silt, trace Concrete
5'		S2	4'-6'	24"	9"	7-4		S2 M-stiff to stiff brown fine Sandy SILT, trace m-c Sand, Fill
						4-7		Concrete (6.0-7.8 ft.)
10'		S3	9'-11'	24"	6"'	4-6		S3 M-dense brown/grey f-m SAND, trace Silt, Wood Concrete - Fill
						13-9	12.0'	
15'		S4	14'-16'	24"	24"	WOR-8		S4 V-stiff yellow/brown Silty CLAY
						13-12		
20'		S5	19'-21'	24"	24"	5-5		S5 Stiff brown/grey Silty CLAY
						9-10	23.8'	
25'		S6	24'-24.6'	6"	5"	42-6/1"		S6 Hard grey SILT, little f-c Gravel, trace f-c Sand, Clay
						50/0"		Boulders 24.5'-25.1'
30'		S7	29'-31'	24"	11"	22-29		S7 Hard grey f-m Sandy SILT, trace coarse Sand, occasional seams of medium and fine Sand
						22-30		
		S8	34'-36'	24"	16"	54-42-49-47		S8 Hard grey SILT, trace f-c Gravel, f-c Sand, Clay

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT	Haley & Aldrich, Inc.
PROJECT	Bedford-Kingston Parcel
LOCATION	Boston, Mass.

Boring # B-101

	CASING	SAMPLER	CORE BARREL
TYPE	HW	SS	--
SIZE	4"	1 3/8"	--
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El:

Station

Ground water

Date	Depth
1/11/89	20.7'

GLI File # 88240

Driller T. Paquette

Consultant W. Rubik

Date Start/Finish 1/9-1/11/89

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
40'		S9	39'-40'	24"	10"	18-16 25-26		S9 Hard grey SILT, trace fine Gravel, f-c Sand, Clay
45'		S10	44'-46'	24"	12"	26-30 46-61		S10 Hard grey SILT, little fine Sand, trace m-c Sand
50'		S11	49'-51'	24"	11"	12-15 15-15	52.5'	S11 V-stiff to hard grey SILT, little fine Sand
55'		S12	54'-55.5'	18"	13"	55-73 100/5.5"		S12 Hard grey SILT, little fine Sand, trace f-c Gravel, m-c Sand
60'		S13	59'-60'	24"	15"	31-28 48-64		S13 Hard grey SILT, trace f-c Sand
65'		S14	64'-65.5'	18"	12"	58-83 100	67.5'	S14 Hard grey SILT, trace coarse Gravel, f-c Sand Top of Bedrock at 67.5'
		S15	69'-69.2'	2"	0.5"	100/1" 100/1"-300#	69.2'	S15 Grey ARGILLITE Refusal at 69.2'-bottom of hole

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks: See Page 3 of 3 for well materials

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT	Haley & Aldrich, Inc.
PROJECT	Bedford-Kingston Parcel
LOCATION	Boston, Mass.
Boring #	B-101
Page	3 - of - 3

	CASING	SAMPLER	CORE BARREL
TYPE	HW	SS	--
SIZE	4"	1 3/8"	--
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El:
Station

Ground water

Date	Depth
1/11/89	20.7'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 1/9-1/11/89

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
								Installed well at 25.0' Well materials: 20' screen 5' solid 1 wellpoint 8 bags sand 20# bentonite 20# cement 1 roadbox

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT	Haley & Aldrich, Inc.	Boring #	B-102
PROJECT	Bedford-Kingston Parcel	Page	1 - of - 3
LOCATION	Boston, Mass.		

	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	NVII
SIZE	4"/3"	1 3/8"	2"
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El: 25.0 (B.C.B.)
Station

Ground water

Date	Depth
12/16/88	9.5'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 12/14-12/16/88

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
							0.4'	Blacktop
		S1	1'-3'	24"	6"	7-5	1.0'	Concrete
						4-11		S1 Brown Silty f-m SAND, trace
		S2	3'-5'	24"	0"	5-4		f-m Gravel, brick
5'						4-5		S2 & S3 Similar to S1
		S3	5'-6.1'	14"	5"	4-7		
						100/0.1'		Concrete (6.1-7.5 ft.)
		S4	7.5'-9.5'	24"	3"	3-4		S4 FILL - m-dense brown f-c
						6-5		Silty Sand, trc Brick, Concrete
10'		S5	9.5'-11.5'	24"	8"	1-2		S5 & S6 M. stiff gray silty
						3-7		Clay
		S6	11.8'-12'	4"	2"	54/4"		S6 - Brick
								Granite Slab (12.0-13.0 ft.)
		S7	13'-15'	24"	19"	WOR-3		S7 FILL - grey Clay, Brick,
15'						4-7		little f-c Sand, Cinders
		S8	15'-17'	24"	0"	11-9		No recovery - pushed cobble w/SS
						25-29	17.0'	
		S9	17'-19'	24"	12"	2-6-6-6		S9 M-dense brown fine SAND,
						w/300#		little Silt
20'		S10	19'-21'	24"	6"	4-6		S10 Stiff grey Silty CLAY
						5-7		
25'		S11	24'-26'	24"	12"	6-8		S11 & S12 Similar to S10
						8-10		
30'		S12	29'-29.5'	6"	6"	3-	29.5'	
		S12A	29.5-31.0	18"	14"	13-14-10		S12A V-stiff grey Clayey SILT,
		S13	31'-33'	24"	18"	3-8		little f-c Sand
						13-18		S13 Similar to S12A
		S14	34'-36'	24"	15"	20-17-19-23		S14 Hrd gry Clayey SILT, f-c Sand

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT	Haley & Aldrich, Inc.	Boring #	B-102
PROJECT	Bedford-Kingston Parcel	Page	2 - of - 3
LOCATION	Boston, Mass.		

	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	NVII
SIZE	4"/3"	1 3/8"	2"
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El:
Station

Ground water Date	Depth
12/16/88	9.5'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 12/14-12/16/88

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
40'		S15	39'-41'	24"	16"	9-9 14-14		S15 Very stiff gray Clayey SILT trace f-c Sand
45'		S16	44'-46'	24"	12"	11-14 19-21		S16 Similar to S15
							49.0'	
50'		S17	49'-51'	24"	18"	31-42 37-34		S17 Hard grey SILT, trace fine Gravel, some f-c Sand, some fine Sand lenses
55'		S18	54'-55.5	18"	12"	39-57		S18 V-dense grey Silty fine SAND with Silt lenses
		S18A	55.5-56.0	6"	5"	-78		S18A Hard grey SILT, trace f-c Sand, trace Clay, few Cobbles, Till
60'		S19	59'-60'	12"	11"	50-100		S19 - S21 Similar to S18A
65'		S20	64'-65.5'	18"	8"	57-55 110		
		S21	69'-71'	24"	22"	35-39-34-43		

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT Haley & Aldrich, Inc.
PROJECT Bedford-Kingston Parcel
LOCATION Boston, Mass.

Boring # B-102

	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	NVII
SIZE	4"/3"	1 3/8"	2"
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El:
Station

Ground water

Date	Depth
12/16/88	9.5'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 12/14-12/16/88

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
							74.4'	
75'		S22	74'-74.4	6"	6"	54-		S22 Similar to S18A
		S22A	74.4-74.6	2"	2"	100/2"		S22A Highly weathered ARGILLITE
							79.5'	
80'		S23	79.5'-79.5'	0"	0"	50		No recovery
		R1	79.5'-84.5'	60"	48"	NVII		R1 Light grey ARGILLITE, highly fractured MPF - 3.5, 3, 3.5, 3.5, 3
85'		R2	84.5'-89.5'	60"	50"	NVII		R2 Similar to R1 MPF - 3, 3.5, 2.5, 2.5, 3
							89.5'	Bottom of hole at 89.5'

Installed well at 25.0'
Well materials:
15' screen
10' solid
1 wellpoint
12 bags sand
35# bentonite
1 roadway box
30# cement

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT Haley & Aldrich, Inc.
PROJECT Bedford-Kingston Parcel
LOCATION Boston, Mass.

Boring # B-103

Page 1 - of - 2

	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	--
SIZE	4"/3"	1 3/8"	--
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El: 21.0 (B.C.B.)
Station

Ground water

Date	Depth
1/12/89	9.0'
1/13/89	10.5'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 1/11-1/13/89

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
							0.1'	Blacktop
								Concrete
								Drilled HW Casing 0' - 9.5'
								Granite Block wall (0.8-9.5 ft.)
5'								
							9.5'	
10'		S1	9.7'-11.7'	24'	22"'	3-4		S1 Stiff yellow Silty CLAY,
						9-13		with fine Sand lenses
15'		S2	15'-17'	24"	24"	5-4		S2 Similar to S1
						4-7		
								Wash shows brown fine Sand (18.5-20.0 ft.)
20'		S3	20'-22'	24"	24"	8-6		S3 Yellow/grey Silty CLAY, some
						5-6		fine Sand lenses
25'		S4	25'-27'	24"	24"	6-5		S4 Stiff grey Silty CLAY
						6-6		
30'		S5	30'-32'	24"	24"	4-3		S5 - S7 Similar to S4
						5-4		

Proportions Used:	
Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)			
0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density	
0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT: Haley & Aldrich, Inc.
PROJECT: Bedford-Kingston Parcel
LOCATION: Boston, Mass.

Boring # B-103

	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	
SIZE	4"/3"	1 3/8"	
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El: ____
Station ____

Ground water

Date	Depth
1/12/89	9.0'
1/13/89	10.5'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 1/11-1/13/89

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
		S6	35.0-37.0	24"	24"	-4-		Stiff gray silty CLAY
						5-6		
40'		S7	40'-41.5'	18"	18"	1-2-3	41.5'	S7 Stiff grey Silty CLAY
		S7A	41.5'-42'	6"	1"	14		S7A V-stiff grey Clayey SILT, some fine Sand, trace coarse Sand
45'		S8	45'-47'	24"	11"	22-15		S8 Hard grey f-m Sandy SILT, some f-c Gravel, with fine Sand lenses
						21-25		
50'		S9	50'-52'	24"	14"	32-35		S9 Hard grey SILT, trace Clay, trace fine Sand, trace f-c Gravel, trace fine Sand lenses, occasional Cobble
						26-38		
55'		S10	55'-57'	24"	4"	21-35		S10 & S11 Similar to S9
						38-36		
60'		S11	60'-62'	24"	1"	34-32		
						31-32		
							63.5'	
65'		S12	65'-67'	24"	12"	32-38		S12 TILL - hard grey Silt, trace f-c Gravel, trace m-c Sand, trace Clay
						37-45	67.0'	Bottom of hole at 67.0'

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT: Haley & Aldrich, Inc.
PROJECT: Bedford-Kingston Parcel
LOCATION: Boston, Mass.

Boring #: B-104
Page 1 -of- 3

	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	NVII
SIZE	4"/3"	1 3/8"	2"
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El: 19.5 (B.C.B.)
Station:

Ground water

Date	Depth

GLI File # 88240
Driller: T. Paquette
Consultant: W. Rubik
Date Start/Finish: 12/22-12/26/88

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
		S1	0.5'-2.5'	24"	3"	12-5	0.5'	Blacktop
						5-5		S1 FILL - misc. Rubble Fill
5'		S2	4'-6'	24"	9"	3-2		S2 Similar to S1
						7-15		
							9.3'	
10'		S3	9.5'-11.5'	24"	20"	7-13		S3 V-stiff yellow Silty CLAY
						16-21		
15'		S4	14.5'-16.5'			6-7		S4 Similar to S3, some fine
						9-14		Sand lenses
		S5	16.5'-17.5'	12"	9"	3-9		S5 Similar to S3
		S5A	17.5-18.5	12"	8"	10-21		S5A Yellow/brown Silty fine
								SAND and CLAY interbedded
20'		S6	19.5'-21.5'	24"	20"	9-14		S6 & S7 Similar to S5A
						14-19		
		S7	21.5'-22.5'	12"	9"	9-13		
		S7A	22.5'-23.5'	12"	12"	10-12		S7A Very stiff grey Silty CLAY
25'		S8	24.5'-26.5'	24"	24"	2-3		S8 Medium stiff grey Silty CLAY
						4-4		
30'		S9	29.5'-31.5'	24"	24"	3-4		S9 Stiff grey Silty CLAY
						6-7		
		S10	34.5'-36.5'	24"	24"	2-4-4-5		S10 Similar to S9

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT: Haley & Aldrich, Inc.
PROJECT: Bedford-Kingston Parcel
LOCATION: Boston, Mass.

Boring # B-104

	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	NVII
SIZE	4"/3"	1 3/8"	2"
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El:
Station

Ground water

Date	Depth

GLI File # 88240
Driller: T. Paquette
Consultant: W. Rubik
Date Start/Finish: 12/22-12/26/88

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
40'		S11	39.5'-41.5'	24"	24"	1-3 3-6		S11M.Stiff grey Silty CLAY
45'		S12	44.5'-46'	18"	18"	1-3-4		S12 Similar to S11
		S12A	46'-46.5'	6"	5"	31	46.0'	S12A Hard grey Sandy SILT, some f-m Gravel
50'		S13	49.5'-51.5'	24"	5"	30-35 33-40		S13 Hard grey SILT, little f-m (trace coarse) Sand, trace f-c Gravel, trace Cobbles, Till
55'		S14	54.5'-56.3'	22"	14"	46-60 50-100/4"		S14 - S17 Similar to S13
60'		S15	59.5'-61'	18"	12"	27-43 84-50/0"		
65'		S16	64.5'-66.5'	24"	20"	22-34 45-40		
		S17	66.5'-68.5'	24"	15"	23-45 46-48		
		S18	69.5'-71.5'	24"	24"	28-33-45-54		S18 Hard gray SILT

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT Haley & Aldrich, Inc.
PROJECT Bedford-Kingston Parcel
LOCATION Boston, Mass.

Boring # B-104

Page 3 - of - 3

	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	NVII
SIZE	4"/3"	1 3/8"	2"
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El:
Station

Ground water

Date	Depth

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 12/22-12/26/88

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
							73.0'	
75'		S19	74.5'-74.8'	3"	2"	100/3"		S19 Weathered ARGILLITE
		R1	76'-80.8'	57"	44"	NVII		R1 Grey ARGILLITE MPF - 4, 4.5, 4, 4, 2
80'		R2	80.8'-85'	51"	39"	NVII		R2 Similar to R1 MPF - 3, 3, 3, 2.5
85'							85.0'	Bottom of hole at 85.0' Installed well at 30.0' Well materials: 25' screen 5' solid 1 wellpoint 6 bags sand 1 roadway box 30# cement

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT Haley & Aldrich, Inc.
PROJECT Bedford-Kingston Parcel
LOCATION Boston, Mass.

Boring # B-105

	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	NVII
SIZE	4"/3"	1 3/8"	2"
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El: 21.0 (B.C.B.)
Station

Ground water

Date	Depth
12/21/88	20.0'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 12/19-12/21/88

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
							0.8'	Blacktop
		S1	1'-3'	24"	15"	22-25		S1 FILL - very dense Brick,
						30-36		Cement, Concrete
		S2	3'-4.5'	18"	12"	58-56		S2 Similar to S1
5'						58		
							7.5'	
10'		S3	9'-11'	24"	20"	6-10		S3 V-stiff yellow Silty CLAY,
						14-19		trace fine Sand lenses
		S4	11'-13'	24"	16"	10-16		S4 Hard yellow Silty CLAY,
						17-17		trace fine Sand lenses
		S5	13.5'-15.5'	24"	24"	5-8		S5 V-stiff yellow Silty CLAY,
15'						8-14		trace fine Sand lenses
		S6	18.5'-20'	18"	18"	9-6-8		S6 Similar to S5
20'		S6A	20'-20.5'	6"	6"	9		S6A Stiff grey Silty CLAY
		S7	20.5'-22.5'	24"	24'	5-6		S7 Similar to S6A
						5-6		
		S8	23.5'-25.5'	24"	24"	3-3		S8 M-stiff grey Silty CLAY
25'						4-7		
		S9	28.5'-30.5'	24"	22"	3-5		S8 Stiff grey Silty CLAY
30'						6-6		
		S10	33.5'-35.5'	24"	24"	4-4		S10 Similar to S9
						5-5		

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT	Haley & Aldrich, Inc.	Boring #	B-105
PROJECT	Bedford-Kingston Parcel	Page	2 - of - 3
LOCATION	Boston, Mass.		

	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	NVII
SIZE	4"/3"	1 3/8"	2"
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El:
Station:

Ground water

Date	Depth
12/21/88	20.0'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 12/19-12/21/88

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
							38.0'	
		S11	38.5'-40.5'	24"	10"	63-28		S11 Hard grey Sandy SILT, some
40'						48-14		f-c Sand, trace coarse Gravel
		S12	40.5'-42'	18"	6"	14-27-92		S12 Similar to S11
								Boulder (42.0-43.5 ft.)
		S13	43.5'-45.5'	24"	7"	17-20		S13 Dense grey f-c SAND, trace
45'						28-37		fine Gravel
							46.5'	
		S14	48.5'-50.5'	24"	3"	30-39		S14 Hard grey SILT, trace
50'						51-45		coarse Gravel, some f-m Sand, Till
		S15	53.5'-55.5'	24"	18"	14-20		S15 Hard grey Sandy SILT, trace
55'						19-36		Clay, trace fine Gravel, some fine Sand lenses, few Cobbles
		S16	58.5'-60.5'	24"	15"	19-21		S16 - S19 Similar to S15
60'						22-33		
		S17	63.5'-65.5'	24"	16"	25-39		
65'						42-37		
		S18	68.5'-69.4'	11"	6"	55-100/5"		

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT: Haley & Aldrich, Inc.
PROJECT: Bedford-Kingston Parcel
LOCATION: Boston, Mass.

Boring # B-105

Page 3 -of- 3

	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	NVII
SIZE	4"/3"	1 3/8"	2"
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El:
Station

Ground water

Date	Depth
12/21/88	20.0'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 12/19-12/22/88

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
		S19	73.5'-74.2'	7"	5"	100-100/3"		S19 Hard grey Sandy SILT, trace Clay, trace fine Gravel, some fine Sand lenses, few Cobbles
75'								
							77.5'	Grey weathered ARGILLITE
		S20	78.5'-78.6'	2"	0"	100/2"		No recovery
80'		R1	79'-82'	36"	27"	NVII		R1 Grey highly fractured ARGILLITE MPF - 3, 3, 2
		R2	82'-86'	48"	33"	NVII		R2 & R3 Similar to R1 MPF - 4, 3, 3, 3
85'								
		R3	86'-89'	36"	36"	NVII		MPF - 2.5, 3, 4
							89.0'	Bottom of hole at 89.0'

Proportions Used:	
Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)			
0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density	
0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC

EARTH EXPLORATION SERVICES

74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172 (617) 923-4420

CLIENT	Haley & Aldrich, Inc.	Boring #	B-106A
PROJECT	Bedford-Kingston Parcel	Page	1 -of- 1
LOCATION	Boston, Mass.		

	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	
SIZE	4"/3"	1 3/8"	
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El: 19.5 (B.C.B.)

Station

Ground water

Date	Depth
12/28/88	10.5'

GLI File # 88240

Driller T. Paquette

Consultant W. Rubik

Date Start/Finish 12/26-12/28/88

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
							0.2'	Blacktop
		S1	1'-3'	24"	11"	24-43		S1 V-dense brown f-m Silty
						25-18		Sand, Fill
		S2	3'-4.5'	18"	.9"	12-13		S2 Similar to S1
		S2A	4.5-5.0'	6"	3"	18		S2A Cinders
5'		S3	5'-7'	24"	10"	5-11		S3 FILL - brown/grey f-m Silty
						15-12		SAND, trace f-c Gravel, Concrete
		S4	7'-9'	24"	4"	6-10		Bricks
						29-79		S4 & S5 Similar to S3
		S5	9'-11'	24"	10"	42-24		
10'						21-29		
		S6	11'-11.9'	10"	2"	21-20/5"		S6 CONCRETE
							14.6'	Refusal on steel at 14.6'
								Moved hole 8' towards Bedford St.

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT	Haley & Aldrich, Inc.
PROJECT	Bedford-Kingston Parcel
LOCATION	Boston, Mass.
Boring #	B-106
Page	1 - of - 2

	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	
SIZE	4"/3"	1 3/8"	
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El: 19.5 (B.C.B.)
Station

Ground water	
Date	Depth
12/28/88	10.5'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 12/26-12/28/88

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
								Spun 4" casing through Rubble Fill to 14.0' and began sampling
5'								
10'								
							14.0'	
15'		S7	14'-16'	24"	9"	5-2 4-9		S7 Medium stiff yellow Silty CLAY
		S8	19'-20'	11"	10"	7-12		S8 Similar to S7
20'		S8A	20-21	12"	12"	15-18		S8A M-dnse brwn Silty fine SAND
		S9	21'-22.5	18"	13"	6-11-12		S9 M-dense brown Sandy SILT
		S9A	22,5-23.0	6	6	11		S9A V-stiff yellow Silty CLAY
25'		S10	24'-26'	24"	24"	2-3 4-4		S10 M-stiff grey Silty CLAY
		S11	28.5'-30.5'	24"	24"	3-4 5-6		S11 - S14 Similar to S10
30'								
		S12	33.5'-35.5'	24"	20"	2-4 5-4		

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT	Haley & Aldrich, Inc.	Boring #	B-106
PROJECT	Bedford-Kingston Parcel	Page	2 - of - 2
LOCATION	Boston, Mass.		

	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	-
SIZE	4"/3"	1 3/8"	-
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El:
Station

Ground water

Date	Depth
12/28/88	10.5'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 12/26-12/28/88

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
		S13	38.5'-40.5'	24"	24"	3-3		S13 M-stiff grey Silty CLAY
40'						5-6		
		S14	43.5'-45.5'	24"	24"	3-4		S14 Similar to S13 with trace fine Sand lenses
45'						5-7		
							46.5'	Boulders (46.5-47.5 ft.)
		S15	48.5'-50.2'	22"	8"	17-21		S15 Grey fine Sandy SILT, some fine Gravel, trace m-c Sand, trace Clay, Till, few Cobbles
50'						81-100/3"		
		S16	53.5'-55.5'	24"	2"	44-74		S16 - S18 Similar to S15
55'						53-62		
		S17	58.5'-60.5'	24"	13"	30-32		
60'						42-48		
65'		S18	64'-66'	24"	14"	36-42		
						37-40	66.0'	Bottom of hole at 66.0'

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT	Haley & Aldrich, Inc.
PROJECT	Bedford-Kingston Parcel
LOCATION	Boston, Mass.
Boring #	B-107
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	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	NVII
SIZE	4"/3"	1 3/8"	2"
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El: 21.5 (B.C.B.)
Station

Ground water

Date	Depth
1/6/89	15.5'
1/10/89	21.3'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 1/5-1/10/89

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
		S1	0.5'-0.8'	4"	3"	100/4"	0.3'	Blacktop
								S1 Misc. Rubble FILL, Brick, Concrete, Steel, Sand, Gravel, etc.
5'		S2	4'-6'	24"	0"	8-2 9-10		No recovery
10'							11.0'	CONCRETE Slab (9.0-11.0 ft.)
		S3	11'-13'	24"	10"	10-12 17-23		S3 V-stiff yellow Silty CLAY, trace f-c Gravel, trace fine Sand
15'		S4	14'-16'	24"	24"	23-25 25-29		S4 Hard yellow Silty CLAY
20'		S5	19'-21'	24"	22"	10-11 11-13		S5 Similar to S4
								Cobble (21.0-21.5 ft.)
25'		S6	24'-26'	24"	24"	4-3 4-5		S6 M-stiff grey Silty CLAY
30'		S7	29'-31'	24"	24"	2-2 5-6		S7 - S10 Similar to S6
		S8	34'-36'	24"	24"	1-4-5-6		

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT	Haley & Aldrich, Inc.	Boring #	B-107
PROJECT	Bedford-Kingston Parcel	Page	2 - of - 3
LOCATION	Boston, Mass.		

	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	NVII
SIZE	4"/3"	1 3/8"	2"
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El: ______
Station ______

Ground water	
Date	Depth
1/6/89	15.5'
1/10/89	21.3'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 1/5-1/10/89

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
10'		S9	39'-41'	24"	24"	3-4		S9 stiff grey Silty CLAY
						6-7		
15'		S10	44'-46'	24"	24"	4-4		S10 Similar to S9
						6-7		
							47.5'	
50'		S11	49'-51'	24"	11"	20-20		S11 Hard grey SILT, trace Clay,
						32-36		trace fine Sand lenses
55'		S12	54'-56'	24"	0"	19-24		No recovery - pushed cobble w/SS
						21-29		
		S13	56'-58'	24"	4"	24-27		S13 Similar to S11 - pushed
						51-97		cobble w/SS
50'		S14	59.5'-61.5'	24"	15"	26-31		S14 & S15 Similar to S11
						39-36		
55'		S15	64.5'-66.5'	24"	24"	16-12		
						15-24		
							68.0'	S16 Glacial TILL - hard grey
								Silt, little fine Sand, f-c
		S16	69'-70.6'	19"	19"	33-44-51-80		Gravel, trace Cobbles

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC

EARTH EXPLORATION SERVICES

74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT Haley & Aldrich, Inc.
PROJECT Bedford-Kingston Parcel
LOCATION Boston, Mass.

Boring # B-107

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	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	NVII
SIZE	4"/3"	1 3/8"	2"
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El: ______
Station ______

Ground water

Date	Depth
1/6/89	15.5'
1/10/89	21.3'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 1/5-1/10/89

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
							73.8'	
75'		S17	74.5'-74.9'	5"	4"	100/5"		S17 Weathered ARGILLITE
		R1	77'-82'	60"	17"	NVII		R1 - R5 Grey ARGILLITE, highly fractured MPF - 4.5, 5.5, 5.5, 5, 5
80'								
		R2	82'-83'	12"	12"	NVII		MPF - 3.5
		R3	83'-85'	24"	16"	NVII		MPF - 3.5, 6.5
85'		R4	85'-87'	24"	17"	NVII		MPF - 4.5, 5
		R5	87'-88.5'	18"	12"	NVII		MPF - 5, 5/6"
		R6	88.5'-92'	42"	21"	NVII		MPF - 1.5/6" 3.5, 6
90'								
							92.0'	Bottom of hole at 92.0'
								Installed well at 25.0' Well materials: 20' screen 5' solid 1 wellpoint 7 bags sand 25# bentonite 1 roadway box 30# cement 14 bags peastone

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC EARTH EXPLORATION SERVICES 74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172 (617) 923-4420	CLIENT Haley & Aldrich, Inc. PROJECT Bedford-Kingston Parcel LOCATION Boston, Mass.	Boring # B-108 Page 1 - of - 2

	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	
SIZE	4"/3"	1 3/8"	
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El: 23.0 (B.C.B.)
Station

Ground water	
Date	Depth
12/29/88	9.5'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 12/28-12/29/88

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
		S1	0.5'-2.5'	24"	16"	12-10	0.5'	Blacktop
						10-12		S1 Misc. Rubble FILL, Concrete,
		S2	2.5'-3.4'	9"	4"	15-100/5"		Brick, Stone, Steel, etc.
								S2 - S6 Similar to S1
5'		S3	4.2'-5'	9"	3"	83-30/5"		
		S4	6.5'-8.5'	24"	11"	23-40		
						83-39		
10'		S5	9'-11'	24"	6"	11-12		
						23-26		
		S6	11'-12.6'	19"	4"	6-17-21		
						9/1 50/0"		
		S7	13'-15'	24"	3"	16-43-140		WOOD (12.6-13.0 ft.)
15'						32 w/300#		S7 M-dense grey coarse SAND,
		S8	15.3'-17.3'	24"	3"	7-4		some f-m Gravel, trce Silt
						10-23		S8 FILL
		S9	17.5'-18.5'	12"	2"	9-13		S9 Similar to S8
		S9A	18.5-19.5'	12"	12"	4-7	18.5'	
20'		S10	19.5'-21.5'	24"	13"	8-9		Stiff yellow Silty CLAY
						9-11		S10 Brown Silty fine SAND
		S11	21.5'-23.5'	24"	14"	9-8		S11 V-stiff yellow Silty CLAY,
						9-8		trace fine Sand lenses
25'		S12	24'-26'	24"	12"	3-2		S12 M-stiff to stiff grey
						3-4		Silty CLAY
30'		S13	29'-31'	24"	22"	4-6		S13 - S15 Similar to S12
						8-9		
		S14	34'-36'	24"	24"	2-3-3-4		

Proportions Used:	
Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)			
0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density	
0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT	Haley & Aldrich, Inc.
PROJECT	Bedford-Kingston Parcel
LOCATION	Boston, Mass.
Boring #	B-108
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	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	
SIZE	4"/3"	1 3/8"	
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El:
Station

Ground water	
Date	Depth
12/29/88	9.5'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 12/28-12/29/88

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
40'		S15	39'-41'	24"	24"	2-4 21-15	42.7'	S15 . stiff grey Silty CLAY, w/one peice coarse Gravel
45'		S16	44'-46'	24"	10"	26-58 25-17		S16 V-dense grey Sandy SILT, some f-c Gravel, trace Cobbles, Till
50'		S17	49'-49.5'	6"	0"	47/3"-140# 18/3"-300#		No recovery Boulder (49.5-51.0 ft.)
55'		S18	54'-56'	24"	14"	22-21 26-23		S18 TILL - hard grey Sandy Silt, trace coarse Sand, some fine Sand lenses, trace f-c Gravel
60'		S19	59'-61'	24"	16"	19-20 26-22		S19 & S20 Similar to S18
65'		S20	64'-66'	24"	18"	16-20 25-33	66.0'	Bottom of hole at 66.0' Installed well at 25.0' Well materials: 20' screen 5' solid, 1 wellpt., 6 bags sand 20# bent., 30# cement, 1 roadbox

Proportions Used:	
Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)			
0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density	
0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT	Haley & Aldrich, Inc.	Boring #	B-109
PROJECT	Bedford-Kingston Parcel	Page	1 - of - 2
LOCATION	Boston, Mass.		

	CASING	SAMPLER	CORE BARREL
TYPE	HW	SS	--
SIZE	4"	1 3/8"	--
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El: 24.0 (B.C.B.)
Station

Ground water	
Date	Depth
1/4/89	15.7'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 1/3-1/4/89

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
		S1	0.5'-2'	18"	4"	10-14	0.3'	Blacktop
						27		S1 FILL - brown f-m Sand,
								Gravel, Brick, Concrete
		S2	4'-6'	24"	7"	4-26		S2 - S4 Similar to S1
5'						11-13		
		S3	8.5'-10.5'	24"	10"	44-55		
0'						24-27		
		S4	14'-14.9'	8"	8"	13-66		
.5'						50/0"		Concrete Slab (14.9-15.5 ft.)
							16.5'	Brown Sand and Gravel - Fill
		S5	19'-21'	24"	24"	10-10		S5 V-stiff yellow Silty CLAY
20'						7-8		
		S6	23.5'-25.5'	24"	24"	2-3		S6 M-stiff to stiff grey
						5-7		Silty CLAY
25'								
		S7	28.5'-30.5'	24"	4"	3-4		S7 & S8 Similar to S6
30'						4-4		
		S8	33.5'-35.5'	24"	12"	2-4		
						4-6		

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT: Haley & Aldrich, Inc.
PROJECT: Bedford-Kingston Parcel
LOCATION: Boston, Mass.

Boring # B-109
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	CASING	SAMPLER	CORE BARREL
TYPE	HW	SS	--
SIZE	4"	1 3/8"	--
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El:
Station

Ground water

Date	Depth
1/4/89	15.7'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 1/3-1/4/89

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
							37.0'	
		S9	38.5'-40.5'	24"	15"	11-10		S9 Grey SILT, trace f-c Sand, some f-c Gravel, Cobbles
40'						9-11		
		S10	43.5'-45.5'	24"	9"	20-26	43.5'	S10 Hard grey SILT, trace Clay, little m-c Sand, trace fine Gravel
45'						30-31		
		S11	48.5'-50.5'	24"	13"	34-31		S11 Hard grey SILT, trace m-c Sand, trace Clay
50'						39-45		
		S12	53.5'-55.5'	24"	18"	56-31		S12 Hard grey SILT, trace m-c Sand, trace Clay, occasional Cobble, some fine Sand lenses
55'						30-30		
		S13	58.5'-60.5'	24"	14"	25-26		S13 - S15 Similar to S12
60'						33-28		
		S14	63.5'-65.1'	20"	20"	30-58		
65'						81-20/1" 50/0"		
		S15	68.5'-68.9'	4"	0"	49/4"-50/0"	68.9'	Bottom of hole at 68.9'

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT Haley & Aldrich, Inc.
PROJECT Bedford-Kingston Parcel
LOCATION Boston, Mass.

Boring # B-110

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	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	NVII
SIZE	4"/3"	1 3/8"	2"
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El: 25.5 (B.C.B.)
Station

Ground water

Date	Depth
12/30/88	15.5'
1/2/89	19.0'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 12/30-1/3/89

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
		S1	0.5'-1.7'	14"	4"	3-4	0.2'	Blacktop
						100/3"		S1 Misc. Rubble FILL, Concrete, Brick, Steel, Wood, Sand, Gravel
								Concrete (1.7-3.9 ft.)
5'		S2	4'-6'	24"	10"	17-9		S2 - S7 Similar to S1
						10-8		
		S3	6'-7.5'	18"	2"	11-12		Concrete (7.5-8.5 ft.)
						102		
		S4	8.5'-9.1'	8"	2"	15-20/1"		Concrete (9.1-10.0 ft.)
						50/0"		
10'		S5	10'-12'	24"	4"	11-14		
						12-13		
		S6	12'-13'	12"	3"	8-15/6"		Concrete (13.0-13.8 ft.)
						50/0"		
15'		S7	14'-14'	0"	0"	50/0"	15.5'	Concrete (14.0-15.5 ft.)
		S8	15.5'-17.5'	24"	3"	6-9		S8 M-dense grey f-c Gravel, little Clay, trace coarse Sand
						12-21		
20'		S9	19'-21'	24"	24"	9-7		S9 Stiff yellow Silty CLAY, little fine Sand lenses
						7-7		
25'		S10	24'-26'	24"	12"	4-4		S10 Stiff grey Silty CLAY
						7-8		
30'		S11	29'-31'	24"	24"	3-5		S11 & S12 Similar to S10
						7-8		
		S12	34'-36'	24"	24"	3-4-6-8		

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT Haley & Aldrich, Inc.
PROJECT Bedford-Kingston Parcel
LOCATION Boston, Mass.

Boring # B-110
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	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	NVII
SIZE	4"/3"	1 3/8"	2"
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El:
Station

Ground water

Date	Depth
12/30/88	15.5'
1/2/89	19.0'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 12/30-1/3/89

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
							38.0'	
40'		S13	39'-41'	24"	24"	16-12 10-11		S13 V-stiff Clayey SILT, some m-c Sand
								Boulder (42.8-43.7 ft.)
45'		S14	44'-46'	24"	13"	14-14 10-11		S14 V. st. gray clayey SILT
50'		S15	49'-51'	24"	3"	18-26 27-38		S15 Similar to S14 with gravel
55'		S16	54'-56'	24"	11"	16-17 21-22		S16 Hard grey Clayey SILT, trace f-c Sand, some fine Sand lenses
60'		S17	59'-61'	24"	18"	8-10 14-16		S17 Similar to S16
							63.0'	
65'		S18	64'-66'	24"	15"	21-22 32-39		S18 Hard grey SILT, little f-c f-c Sand, trace Silt
		S19	69'-70.4'	15"	10"	40-61-100/5"		S19 Similar to S18

Proportions Used:

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)

0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density

0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Geo Logic, INC
EARTH EXPLORATION SERVICES
74 ACTON STREET WATERTOWN, MASSACHUSETTS 02172
(617) 923-4420

CLIENT Haley & Aldrich, Inc.
PROJECT Bedford-Kingston Parcel
LOCATION Boston, Mass.

Boring # B-110
Page 3 - of - 3

	CASING	SAMPLER	CORE BARREL
TYPE	HW/NW	SS	NVII
SIZE	4"/3"	1 3/8"	2"
HAMMER	Spun	140#	--
FALL	--	30"	--

Surface El:
Station

Ground water

Date	Depth
12/30/88	15.5'
1/2/89	19.0'

GLI File # 88240
Driller T. Paquette
Consultant W. Rubik
Date Start/Finish 12/30-1/3/89

Depth	Cas bl/ft	Sample No.	Sample Depth	Pen.	Rec.	Blows/6"	Strata Change	Sample Description
							73.0'	
		S20	74'-74.1'	2"	2"	100/2"		S20 Weathered ARGILLITE
75'		R1	75'-77.5'	30"	27	NVII		R1 - R3 Grey ARGILLITE, highly fractured MPF - 4.5, 4, 2.5/6"
		R2	77.5'-79'	18"	20	NVII		MPF - 2/6", 4
		R3	79'-80.5'	18"	8	NVII		MPF - 4, 3/6"
80'							80.5'	Bottom of hole at 80.5'
								Note: Boring called by Client after rock hole collapsed

Proportions Used:	
Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

Cohesive Consistency (Blows/Ft.)			
0-2	Very Soft	9-15	Stiff
3-4	Soft	16-30	V-Stiff
5-8	M-Stiff	31+	Hard

Cohesionless Density	
0-10	Loose
10-30	M-Dense
30-50	Dense
50+	V-Dense

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks:

Appendix B

APPENDIX B

Groundwater Observation Well Installation
and Monitoring Reports

Haley & Aldrich, Inc.

GROUNDWATER OBSERVATION WELL REPORT

WELL NO. B-101 (OW)
FILE NO. 06691-00

PROJECT KINGSTON-BEDFORD DEVELOPMENT
LOCATION BEDFORD STREET, BOSTON, MASSACHUSETTS
CLIENT METROPOLITAN/COLUMBIA PLAZA VENTURE
CONTRACTOR GEO-LOGIC, INC.
DRILLER T. PAQUETTE

BORING NO. B-101
LOCATION See Plan
INSTALLATION DATE 11 Jan 89
H&A REP W. RUBIK

SURVEY DATUM Boston City Base

GROUND ELEVATION 26.5

SUMMARIZE SOIL CONDITIONS (NOT TO SCALE)

Soil	Depth	Backfill
FILL	3.0	BENTONITE
	4.5	OTTAWA SAND
MARINE CLAY	12.0	
	23.8	
	25.5	BENTONITE
GLACIO-MARINE	26.5	CRUSHED STONE AND OTTAWA SAND
GLACIAL TILL	52.5	
ARGILLITE	67.5	

~~ELEVATION OR~~ STICKUP ABOVE/BELOW GROUND SURFACE OF CASING OR ROADWAY BOX: 0.0

~~ELEVATION OR~~ STICKUP ~~ABOVE~~/BELOW GROUND SURFACE OF RISER PIPE: 3.0 in.

THICKNESS OF SURFACE SEAL: 1.5 in.

TYPE OF SURFACE SEAL: Bentonite

[INDICATE ALL SEALS SHOWING DEPTH, THICKNESS AND TYPE]

TYPE OF CASING: Roadway Box

INSIDE DIAMETER OF CASING: 3.0 in.

~~ELEVATION~~/DEPTH OF BOTTOM OF CASING: 2.0 in.

INSIDE DIAMETER OF RISER PIPE: 2.0 in.

TYPE OF BACKFILL AROUND RISER: Ottawa Sand

DIAMETER OF BOREHOLE: 4.5 in.

~~ELEVATION~~/DEPTH OF BOTTOM OF RISER: 5.0 ft.

TYPE OF POINT OR MANUFACTURER: MACHINE SLOTTED PVC

SCREEN GAUGE OR SIZE OF OPENINGS: 0.010 in.

DIAMETER OF WELLPOINT: 2.0 in.

TYPE OF BACKFILL AROUND POINT: Ottawa Sand

~~ELEVATION~~/DEPTH OF BOTTOM OF POINT: 25.0 ft.

~~ELEVATION~~/DEPTH OF BOTTOM OF BOREHOLE: 69.2 ft.

Bottom of Exploration at 69.2 ft.

[FIGURES REFER TO: EL. ______ DEPTH X]

LENGTH OF CASING (L_3)	LENGTH OF RISER PIPE (L_1)	+	LENGTH OF POINT (L_2)	=	PAY LENGTH
2.0'	5.0'	+	20.0'	=	25.0'

Form 59 Rev. Feb. 88

HALEY & ALDRICH, INC. CAMBRIDGE, MASSACHUSETTS	GROUND WATER MONITORING REPORT

OW/PZ NUMBER: B101 (OW) ELEVATION SUBTRAHEND 26.5 FILE NO. 06691-00 PAGE NO. 1

DATE	TIME	ELAPSED TIME	DEPTH OF WATER FROM GS	ELEVATION OF WATER	REMARKS	READ BY
11 Jan 89	10:18	0	9.4	17.1	Installed	WR
12 Jan 89	07:15	1 Day	20.6	5.9	Not Stabilized	WR
13 Jan 89	07:05	2 Days	21.6	4.9	Heavy Rain	WR

Note: Elevations refer to Boston City Base Datum

H&A JAN. 78 39A

Haley & Aldrich, Inc.

GROUNDWATER OBSERVATION WELL REPORT

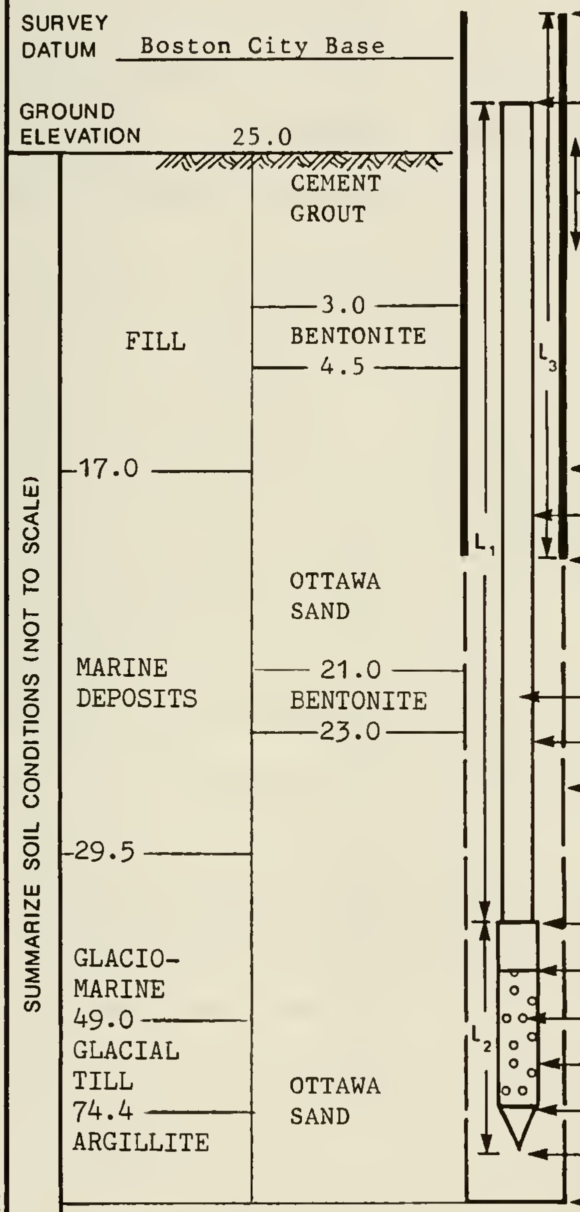
WELL NO. B-102 (OW)
FILE NO. 06691-00

PROJECT KINGSTON-BEDFORD DEVELOPMENT
LOCATION BEDFORD STREET, BOSTON, MA
CLIENT METROPOLITAN/COLUMBIA PLAZA VENTURE
CONTRACTOR GEO-LOGIC, INC.
DRILLER T. PAQUETTE

BORING NO. B-102
LOCATION See Plan
INSTALLATION DATE 29 Dec 88
H&A REP W. RUBIK

SURVEY DATUM Boston City Base

GROUND ELEVATION 25.0



~~ELEVATION OR~~ STICKUP ABOVE/BELOW GROUND SURFACE OF CASING OR ROADWAY BOX	0.0
~~ELEVATION OR~~ STICKUP ~~ABOVE~~/BELOW GROUND SURFACE OF RISER PIPE	1.0 in.
THICKNESS OF SURFACE SEAL	1.5 in.
TYPE OF SURFACE SEAL	Bentonite
[INDICATE ALL SEALS SHOWING DEPTH, THICKNESS AND TYPE]	
TYPE OF CASING	Roadway Box
INSIDE DIAMETER OF CASING	3.0 in.
~~ELEVATION~~/DEPTH OF BOTTOM OF CASING	2.0 ft.
INSIDE DIAMETER OF RISER PIPE	2.0 in.
TYPE OF BACKFILL AROUND RISER	Ottawa Sand
DIAMETER OF BOREHOLE	4.5 in.
~~ELEVATION~~/DEPTH OF BOTTOM OF RISER	5.0 ft.
TYPE OF POINT OR MANUFACTURER	MACHINE SLOTTED PVC
SCREEN GAUGE OR SIZE OF OPENINGS	0.010 in.
DIAMETER OF WELLPOINT	2.0 in.
TYPE OF BACKFILL AROUND POINT	Ottawa Sand
~~ELEVATION~~/DEPTH OF BOTTOM OF POINT	20.0 ft.
~~ELEVATION~~/DEPTH OF BOTTOM OF BOREHOLE	89.5 ft.

[FIGURES REFER TO: EL. ______ DEPTH X]

2.0	5.0	+	15.0	=	20.0
LENGTH OF CASING (L_3)	LENGTH OF RISER PIPE (L_1)		LENGTH OF POINT (L_2)		PAY LENGTH

GW = 9.1 ft. (not stabilized)

HALEY & ALDRICH, INC. CAMBRIDGE, MASSACHUSETTS	GROUND WATER MONITORING REPORT

OW/PZ NUMBER: B102-(OW) ELEVATION SUBTRAHEND 25.0 FILE NO. 06691-00 PAGE NO. 1

DATE	TIME	ELAPSED TIME	DEPTH OF WATER FROM GS	ELEVATION OF WATER	REMARKS	READ BY
19 Dec 1988	10:07	0	9.1	15.9	Not Stabilized	WR
28 Dec 1988	11:20	9 Days	14.2	10.8		WR
9 Jan 1989	07:10	21 Days	15.5	9.5		WR
10 Jan 1989	06:55	22 Days	15.7	9.3		WR
11 Jan 1989	07:00	23 Days	15.5	9.5		WR
12 Jan 1989	07:17	24 Days	15.6	9.4		WR
13 Jan 1989	07:09	25 Days	12.6	12.4	Heavy Rain	WR

Note: Elevations refer to Boston City Base Datum

FORM H&A JAN. 78 59A

Haley & Aldrich, Inc.

GROUNDWATER OBSERVATION WELL REPORT

WELL NO. B-104 (OW)
FILE NO. 06691-00

PROJECT KINGSTON-BEDFORD DEVELOPMENT
LOCATION BEDFORD STREET, BOSTON, MA
CLIENT METROPOLITAN/COLUMBIA PLAZA VENTURE
CONTRACTOR GEO-LOGIC, INC.
DRILLER T. PAQUETTE

BORING NO. B-104
LOCATION See Plan
INSTALLATION DATE 26 Dec 88
H&A REP W. RUBIK

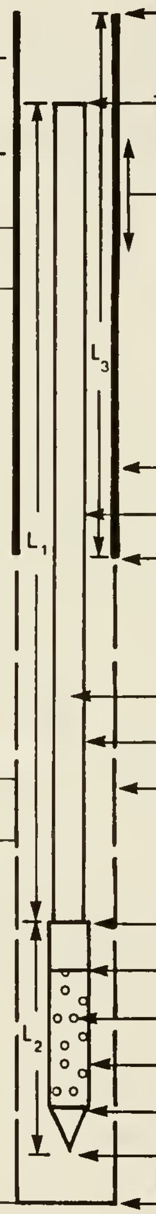
SURVEY DATUM Boston City Base

GROUND ELEVATION 19.5

SUMMARIZE SOIL CONDITIONS (NOT TO SCALE)

Soil	Depth	Backfill	Depth
FILL			3.0
		BENTONITE	
			4.5
	9.3		
MARINE DEPOSITS		OTTAWA SAND	
			31.0
		BENTONITE	
			32.0
	46.0		
GLACIAL TILL		BOREHOLE CUTTINGS AND OTTAWA SAND	
	73.0		
ARGILLITE			

Bottom of Exploration at 85.0 ft.



~~ELEVATION OR~~ STICKUP ABOVE/BELOW GROUND SURFACE OF CASING OR ROADWAY BOX	0.0
~~ELEVATION OR~~ STICKUP ~~ABOVE/~~BELOW GROUND SURFACE OF RISER PIPE	4.5 in.
THICKNESS OF SURFACE SEAL	1.5 in.
TYPE OF SURFACE SEAL	Bentonite
[INDICATE ALL SEALS SHOWING DEPTH, THICKNESS AND TYPE]	
TYPE OF CASING	Roadway Box
INSIDE DIAMETER OF CASING	3.0 in.
~~ELEVATION/~~DEPTH OF BOTTOM OF CASING	2.0 ft.
INSIDE DIAMETER OF RISER PIPE	2.0 in.
TYPE OF BACKFILL AROUND RISER	Ottawa Sand
DIAMETER OF BOREHOLE	4.5 in.
~~ELEVATION/~~DEPTH OF BOTTOM OF RISER	5.0 ft.
TYPE OF POINT OR MANUFACTURER	MACHINE SLOTTED PVC
SCREEN GAUGE OR SIZE OF OPENINGS	0.010 in.
DIAMETER OF WELLPOINT	2.0 in.
TYPE OF BACKFILL AROUND POINT	Ottawa Sand
~~ELEVATION/~~DEPTH OF BOTTOM OF POINT	30.0 ft.
~~ELEVATION/~~DEPTH OF BOTTOM OF BOREHOLE	85.0 ft.

[FIGURES REFER TO: EL. ______ DEPTH X]

[2.0 LENGTH OF CASING (L_3)] [5.0 LENGTH OF RISER PIPE (L_1) + 25.0 ft. LENGTH OF POINT (L_2) = 30.0 ft. PAY LENGTH]

Form 59 Rev. Feb. 88

HALEY & ALDRICH, INC. CAMBRIDGE, MASSACHUSETTS	GROUND WATER MONITORING REPORT

OW/PZ NUMBER: B104-(OW) ELEVATION SUBTRAHEND 19.5 FILE NO. 06691-00 PAGE NO. 1

DATE	TIME	ELAPSED TIME	DEPTH OF WATER FROM GS	ELEVATION OF WATER	REMARKS	READ BY
28 Dec 88	11:30	0	12.5	7.0		WR
9 Jan 89	07:15	12 Days	12.9	6.6		WR
10 Jan 89	08:27	13 Days	13.0	6.5		WR
11 Jan 89	07:06	14 Days	12.9	6.6		WR
12 Jan 89	07:06	15 Days	12.9	6.6		WR
13 Jan 89	09:13	16 Days	12.9	6.6	Heavy Rain	WR
Note: Elevations refer to Boston City Base Datum						

H&A FORM 59A JAN. 78

Haley & Aldrich, Inc.	**GROUNDWATER OBSERVATION WELL REPORT**	WELL NO. B107-(OW) FILE NO. 06691-00

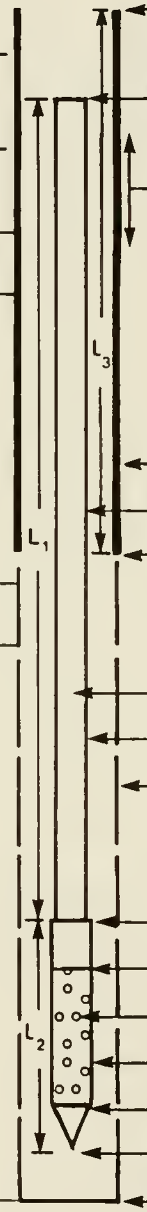
PROJECT: KINGSTON-BEDFORD DEVELOPMENT	BORING NO. B-107
LOCATION: BEDFORD STREET, BOSTON, MA	LOCATION: See Plan
CLIENT: METROPOLITAN/COLUMBIA PLAZA VENTURE	
CONTRACTOR: GEO-LOGIC, INC.	INSTALLATION DATE: 9 Jan 89
DRILLER: T. PAQUETTE	H&A REP: W. RUBIK

SURVEY DATUM: Boston City Base

GROUND ELEVATION: 21.5

SUMMARIZE SOIL CONDITIONS (NOT TO SCALE)

Soil	Depth	Backfill
FILL	3.0	BENTONITE
	4.5	OTTAWA SAND
MARINE DEPOSITS	11.0	
	25.5	BENTONITE
	26.5	OTTAWA SAND, CRUSHED STONE, BOREHOLE CUTTINGS
GLACIO-MARINE	47.5	
GLACIAL	68.0	
ARGILLITE	73.8	



~~ELEVATION OR~~ STICKUP ABOVE/BELOW GROUND SURFACE OF CASING OR ROADWAY BOX	0.0
~~ELEVATION OR~~ STICKUP ~~ABOVE~~/BELOW GROUND SURFACE OF RISER PIPE	2.5 in.
THICKNESS OF SURFACE SEAL	1.5 in.
TYPE OF SURFACE SEAL	Bentonite
[INDICATE ALL SEALS SHOWING DEPTH, THICKNESS AND TYPE]	
TYPE OF CASING	Roadway Box
INSIDE DIAMETER OF CASING	3.0 in.
~~ELEVATION~~/DEPTH OF BOTTOM OF CASING	2.0 ft.
INSIDE DIAMETER OF RISER PIPE	2.0 in.
TYPE OF BACKFILL AROUND RISER	Ottawa Sand
DIAMETER OF BOREHOLE	4.5 in.
~~ELEVATION~~/DEPTH OF BOTTOM OF RISER	5.0 ft.
TYPE OF POINT OR MANUFACTURER	MACHINE SLOTTED PVC
SCREEN GAUGE OR SIZE OF OPENINGS	0.010 in.
DIAMETER OF WELLPOINT	2.0 in.
TYPE OF BACKFILL AROUND POINT	Ottawa Sand
~~ELEVATION~~/DEPTH OF BOTTOM OF POINT	25.0 ft.
~~ELEVATION~~/DEPTH OF BOTTOM OF BOREHOLE	92.0 ft.

Bottom of Exploration at 92.0 ft.

[FIGURES REFER TO: EL. ______ DEPTH X]

2.0	5.0	+	20.0	=	25.0
LENGTH OF CASING (L_3)	LENGTH OF RISER PIPE (L_1)		LENGTH OF POINT (L_2)		PAY LENGTH

Form 59 Rev. Feb. 88

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

GROUND WATER MONITORING REPORT

OW/PZ NUMBER: B107-(OW)

ELEVATION SUBTRAHEND 21.5

FILE NO. 06691-00
PAGE NO. 1

DATE	TIME	ELAPSED TIME	DEPTH OF WATER FROM GS	ELEVATION OF WATER	REMARKS	READ BY
10 Jan 89	07:05	20 hrs	13.4	8.1	Not stabilized	WR
11 Jan 89	07:12	1 day	13.6	7.9		WR
12 Jan 89	07:11	2 days	13.6	7.9		WR
13 Jan 89	07:00	3 days	13.7	7.8		WR

Note: Elevations refer to Boston City Base Datum

Haley & Aldrich, Inc.

GROUNDWATER OBSERVATION WELL REPORT

WELL NO. B108-(OW)

FILE NO. 06691-00

PROJECT KINGSTON-BEDFORD DEVELOPMENT

LOCATION BEDFORD STREET, BOSTON, MA

CLIENT METROPOLITAN/COLUMBIA PLAZA VENTURE

CONTRACTOR GEO-LOGIC, INC.

DRILLER T. PAQUETTE

BORING NO. B-108

LOCATION See Plan

INSTALLATION DATE 30 Dec 88

H& A REP W. RUBIK

SURVEY DATUM Boston City Base

GROUND ELEVATION 23.0

SUMMARIZE SOIL CONDITIONS (NOT TO SCALE)

FILL

— 18.5 —

MARINE DEPOSITS

— 42.7 —

GLACIAL TILL

CEMENT GROUT

OTTAWA SAND

— 3.0 —

BENTONITE

— 4.5 —

OTTAWA SAND

— 26.0 —

BENTONITE

— 27.0 —

BOREHOLE CUTTINGS

Bottom of Exploration at 66.0 ft.

~~ELEVATION OR~~ STICKUP ABOVE/BELOW GROUND SURFACE OF CASING OR ROADWAY BOX	0.0
~~ELEVATION~~ OR STICKUP ~~ABOVE~~/BELOW GROUND SURFACE OF RISER PIPE	3.0 in.
THICKNESS OF SURFACE SEAL	1.5 in.
TYPE OF SURFACE SEAL	Bentonite
[INDICATE ALL SEALS SHOWING DEPTH, THICKNESS AND TYPE]	
TYPE OF CASING	Roadway Box
INSIDE DIAMETER OF CASING	3.0 in.
~~ELEVATION~~/DEPTH OF BOTTOM OF CASING	2.0 ft.
INSIDE DIAMETER OF RISER PIPE	2.0 in.
TYPE OF BACKFILL AROUND RISER	Ottawa Sand
DIAMETER OF BOREHOLE	4.5 in.
~~ELEVATION~~/DEPTH OF BOTTOM OF RISER	5.0 ft.
TYPE OF POINT OR MANUFACTURER	MACHINE SLOTTED PVC
SCREEN GAUGE OR SIZE OF OPENINGS	0.010 in.
DIAMETER OF WELLPOINT	2.0 in.
TYPE OF BACKFILL AROUND POINT	Ottawa Sand
~~ELEVATION~~/DEPTH OF BOTTOM OF POINT	25.0 ft.
~~ELEVATION~~/DEPTH OF BOTTOM OF BOREHOLE	66.0 ft.

[FIGURES REFER TO: EL. ______ DEPTH X]

[2.0 LENGTH OF CASING (L_3)] [5.0 LENGTH OF RISER PIPE (L_1) + 20.0 LENGTH OF POINT (L_2) = 25.0 PAY LENGTH]

Form 59 Rev. Feb. 88

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

GROUND WATER MONITORING REPORT

OW/PZ NUMBER: B108-(OW)

ELEVATION SUBTRAHEND 23.0

FILE NO. 06691-00
PAGE NO. 1

DATE	TIME	ELAPSED TIME	DEPTH OF WATER FROM GS	ELEVATION OF WATER	REMARKS	READ BY
3 Jan 89	10:20	0	13.1	9.9		WR
9 Jan 89	07:06	6 Days	12.6	10.4		WR
10 Jan 89	07:08	7 Days	12.6	10.4		WR
11 Jan 89	07:10	8 Days	12.6	10.4		WR
12 Jan 89	07:09	9 Days	12.7	10.3		WR
13 Jan 89	06:55	10 Days	12.7	10.3	Heavy Rain	WR

Note: Elevations refer to Boston City Base Datum

Appendix C

APPENDIX C

Test Pit Log and Photographs

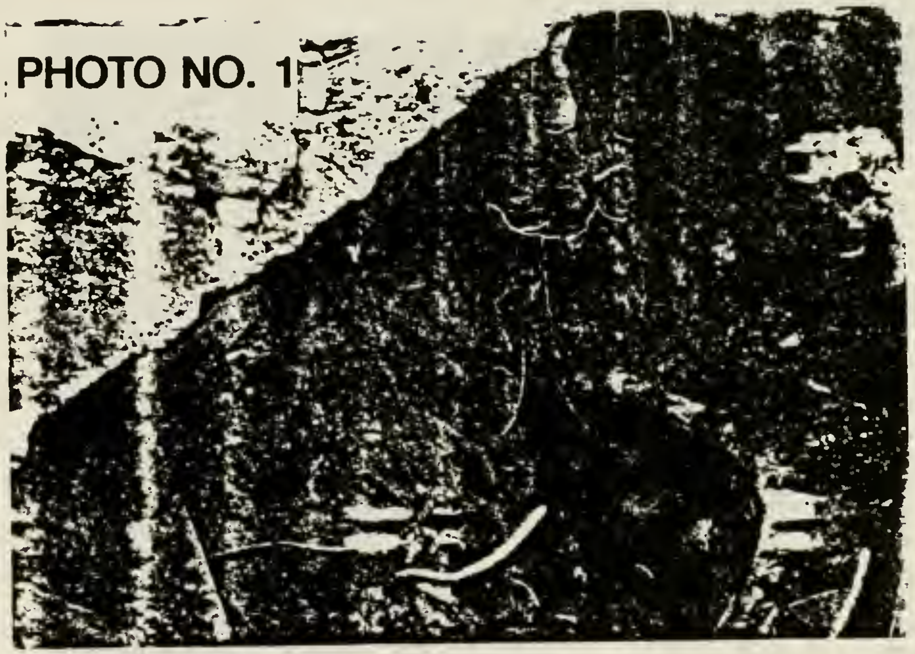


PHOTO NO. 1


PHOTO NO. 2

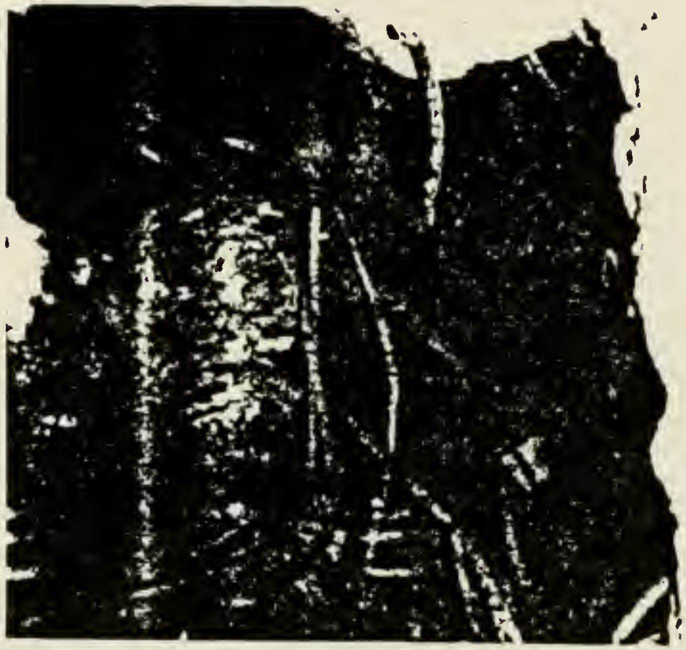


PHOTO NO. 3

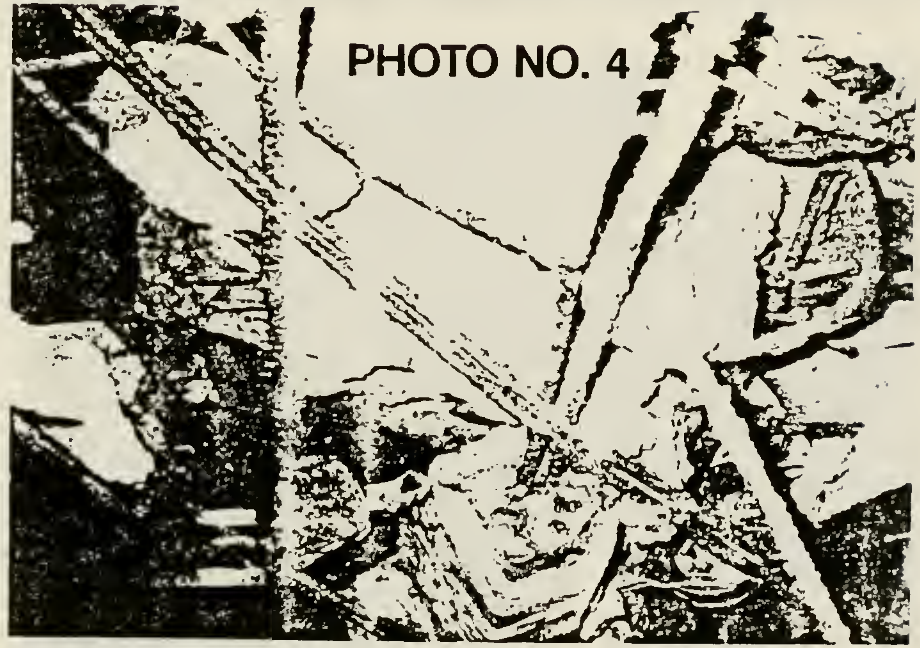


PHOTO NO. 4


PHOTO NO. 6

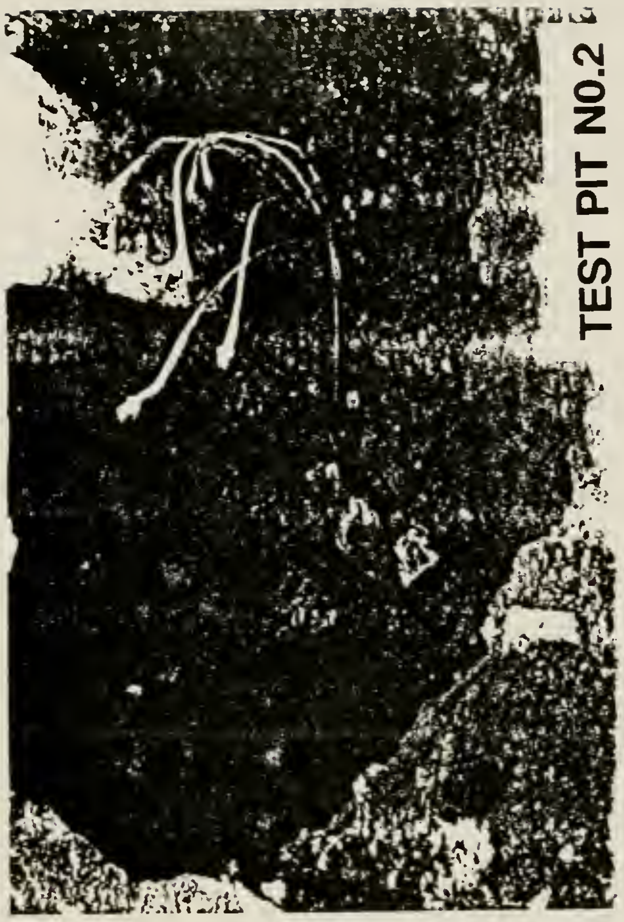

TEST PIT NO.2

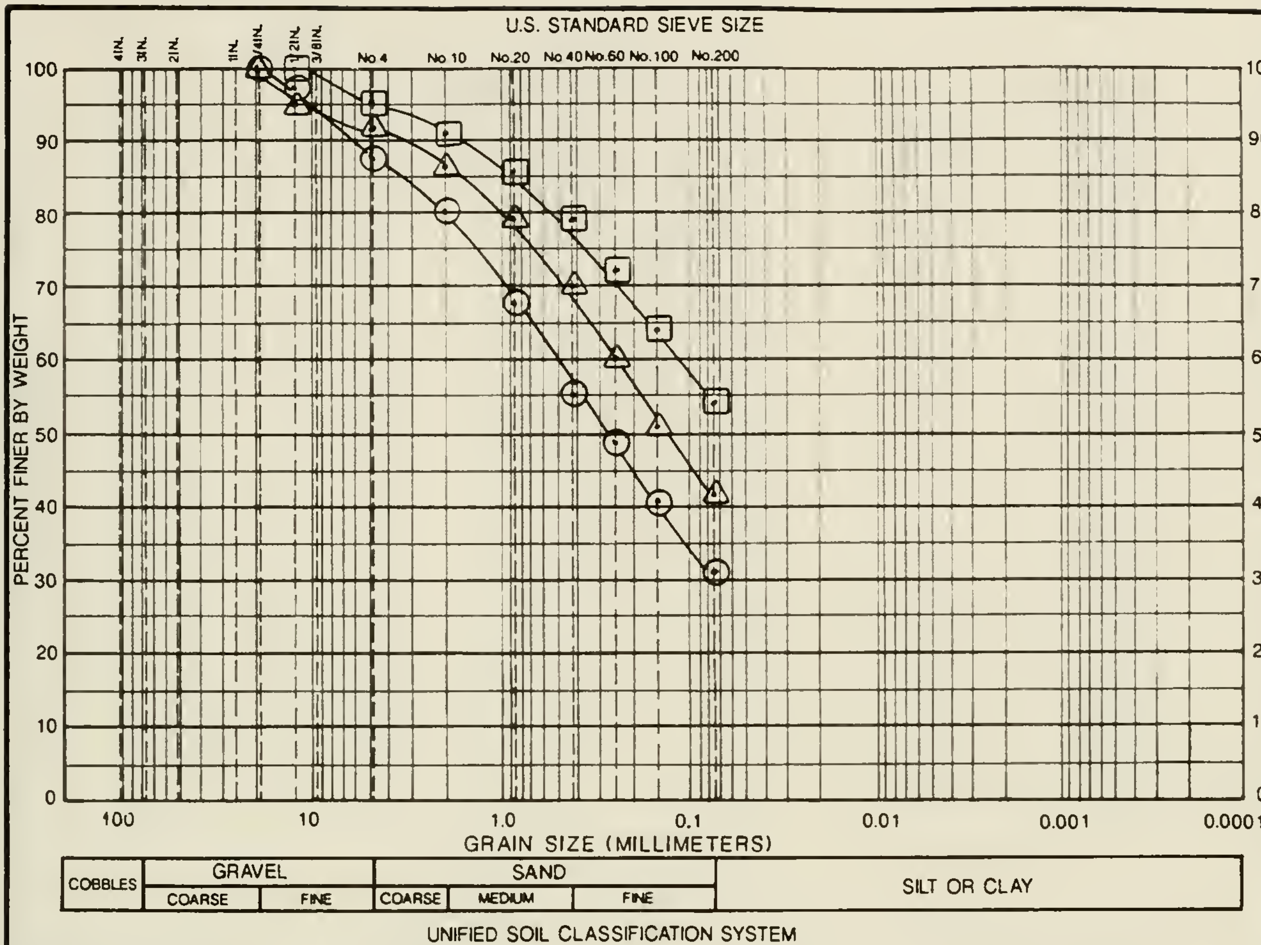

PHOTO NO. 5

Appendix D

APPENDIX D

Laboratory Test Results

H&A FORM No. 505 JUNE 1988



SYMBOL	EXPL. NO.	SAMPLE NO.	DEPTH (feet)	SAMPLE SOURCE	PROPOSED USE	SAMPLE DESCRIPTION
⊙	B101	S7	29.0-31.0			Brown silty medium to fine SAND, little fine gravel, trace coarse sand
△	B101	S12	54.0-55.5			Brown silty medium to fine SAND, trace fine gravel
⊡	B102	S14	34.0-36.0			Brown sandy SILT

SYMBOL	EXPL. NO.	SAMPLE NO.	C_u	C_c	NATURAL WATER CONTENT(%)	ATTERBERG LIMITS (%) W_L	W_p	I_p	L O I (% by wgt.)	
⊙	B101	S7			10.1					
△	B101	S12			10.0					
⊡	B101	S14			9.8					

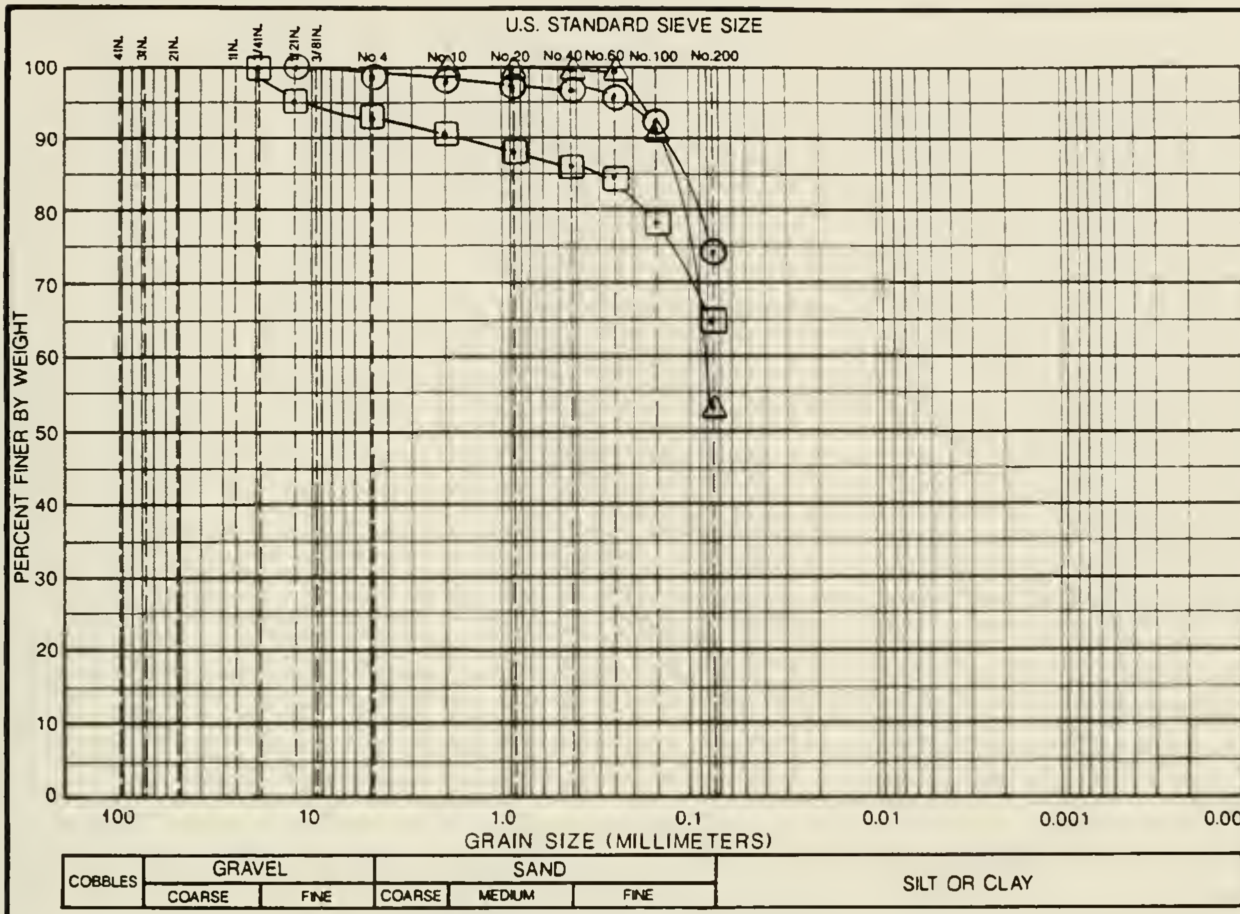
Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

Kingston-Bedford Parcel
Boston, Massachusetts

GRAIN SIZE DISTRIBUTION

FILE NO. 06691-00 DATE: Feb. 1989

H&A FORM No. 505 JUNE 1988



UNIFIED SOIL CLASSIFICATION SYSTEM

SYMBOL	EXPL. NO.	SAMPLE NO.	DEPTH (feet)	SAMPLE SOURCE	PROPOSED USE	SAMPLE DESCRIPTION
⊙	B102	S18	54.0-55.0			Brown fine sandy SILT
△	B104	S6	19.5-21.5			Brown fine sandy SILT
⊡	B104	S15	59.0-61.0			Brown sandy SILT, trace fine gravel

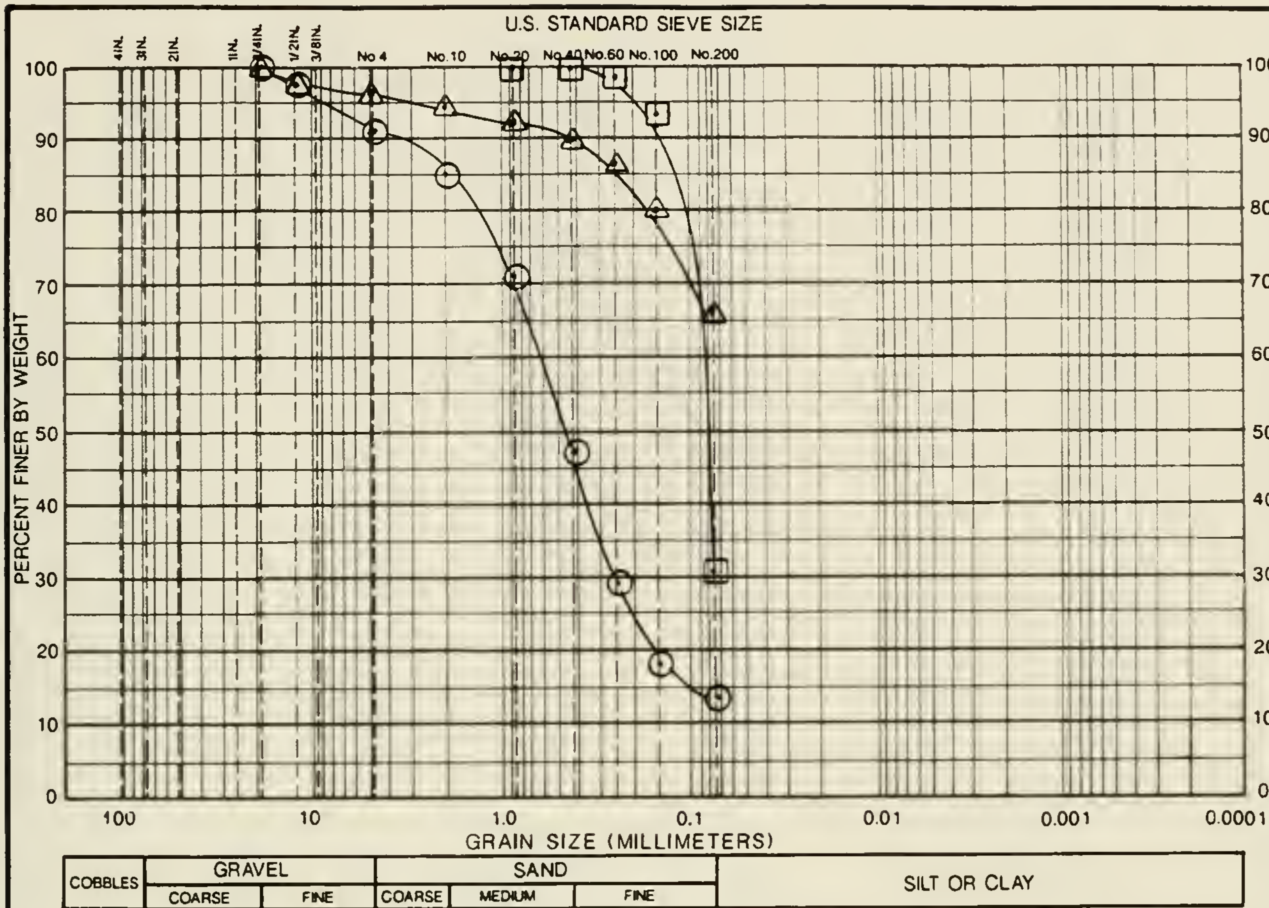
SYMBOL	EXPL. NO.	SAMPLE NO.	C_u	C_c	NATURAL WATER CONTENT(%)	ATTERBERG LIMITS (%) W_L	W_p	I_p	LOI (% by wgt.)	
⊙	B102	S18			15.4					
△	B104	S6			22.3					
⊡	B104	S15			12.7					

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

Kingston-Bedford Parcel
Boston, Massachusetts

GRAIN SIZE DISTRIBUTION

FILE NO. 06691-00 DATE: Feb. 1989



UNIFIED SOIL CLASSIFICATION SYSTEM

SYMBOL	EXPL. NO.	SAMPLE NO.	DEPTH (feet)	SAMPLE SOURCE	PROPOSED USE	SAMPLE DESCRIPTION
⊙	B105	S13	43.5-45.5			Brown medium to fine SAND, little silt, trace fine gravel and coarse sand
△	B105	S16	58.5-60.5			Brown fine sandy SILT
⊡	B106	S8A	20.0-21.0			Brown silty fine SAND

SYMBOL	EXPL. NO.	SAMPLE NO.	C_u	C_c	NATURAL WATER CONTENT(%)	ATTERBERG LIMITS (%) W_L W_p I_p	L O I (% by wgt.)	
⊙	B105	S13			12.9			
△	B105	S16			11.5			
⊡	B106	S8A			23.9			

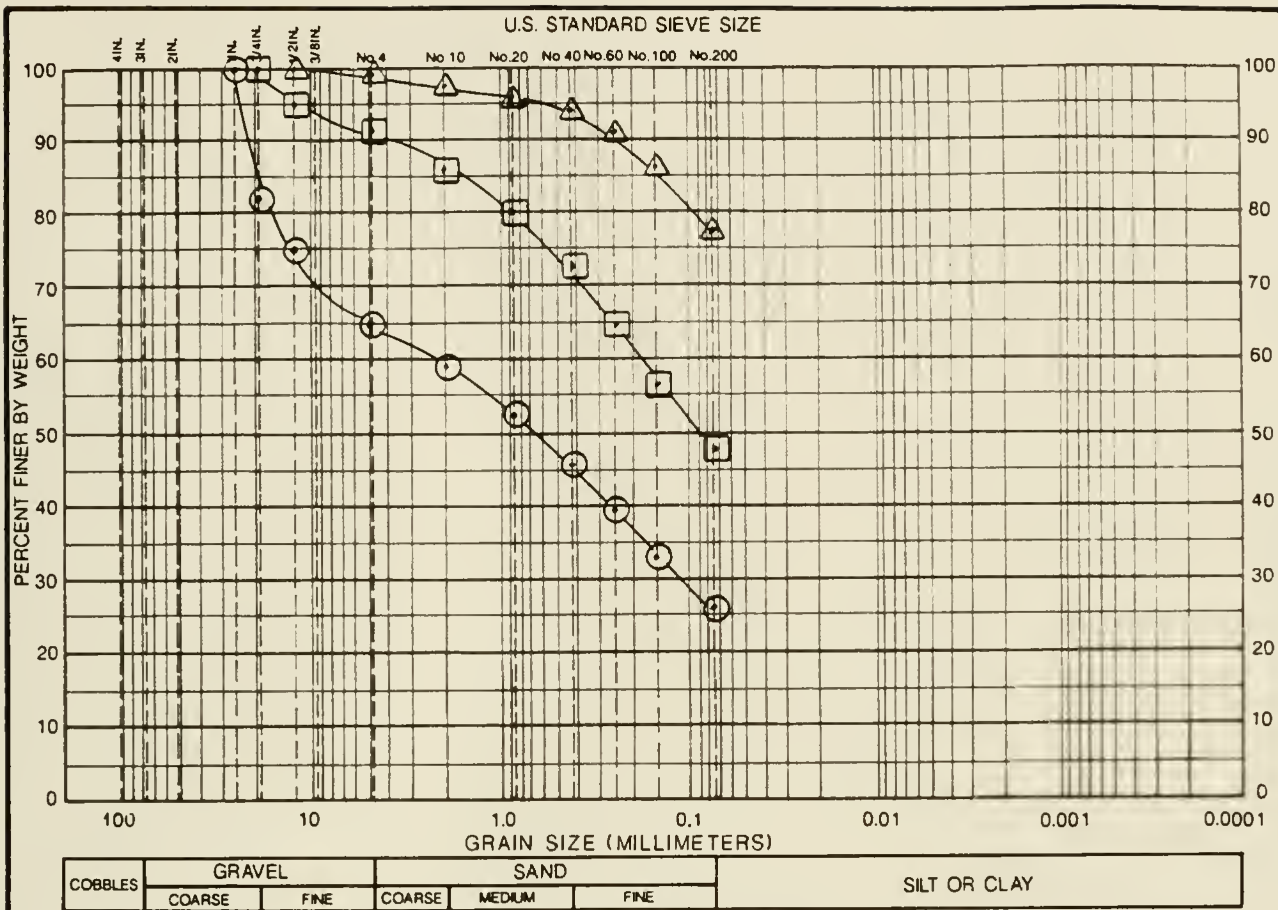
Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

Kingston-Bedford Parcel
Boston, Massachusetts

GRAIN SIZE DISTRIBUTION

FILE NO. 06691 DATE: Feb. 1989

H&A FORM No. 505 JUNE 1988



UNIFIED SOIL CLASSIFICATION SYSTEM

SYMBOL	EXPL. NO.	SAMPLE NO.	DEPTH (feet)	SAMPLE SOURCE	PROPOSED USE	SAMPLE DESCRIPTION
⊙	B106	S15	48.5-50.2			Brown gravelly medium to fine SAND, some silt, trace coarse sand
△	B110	S16	54.0-56.0			Brown fine sandy SILT
⊡	B110	S18	64.0-66.0			Brown silty medium to fine SAND, trace fine gravel

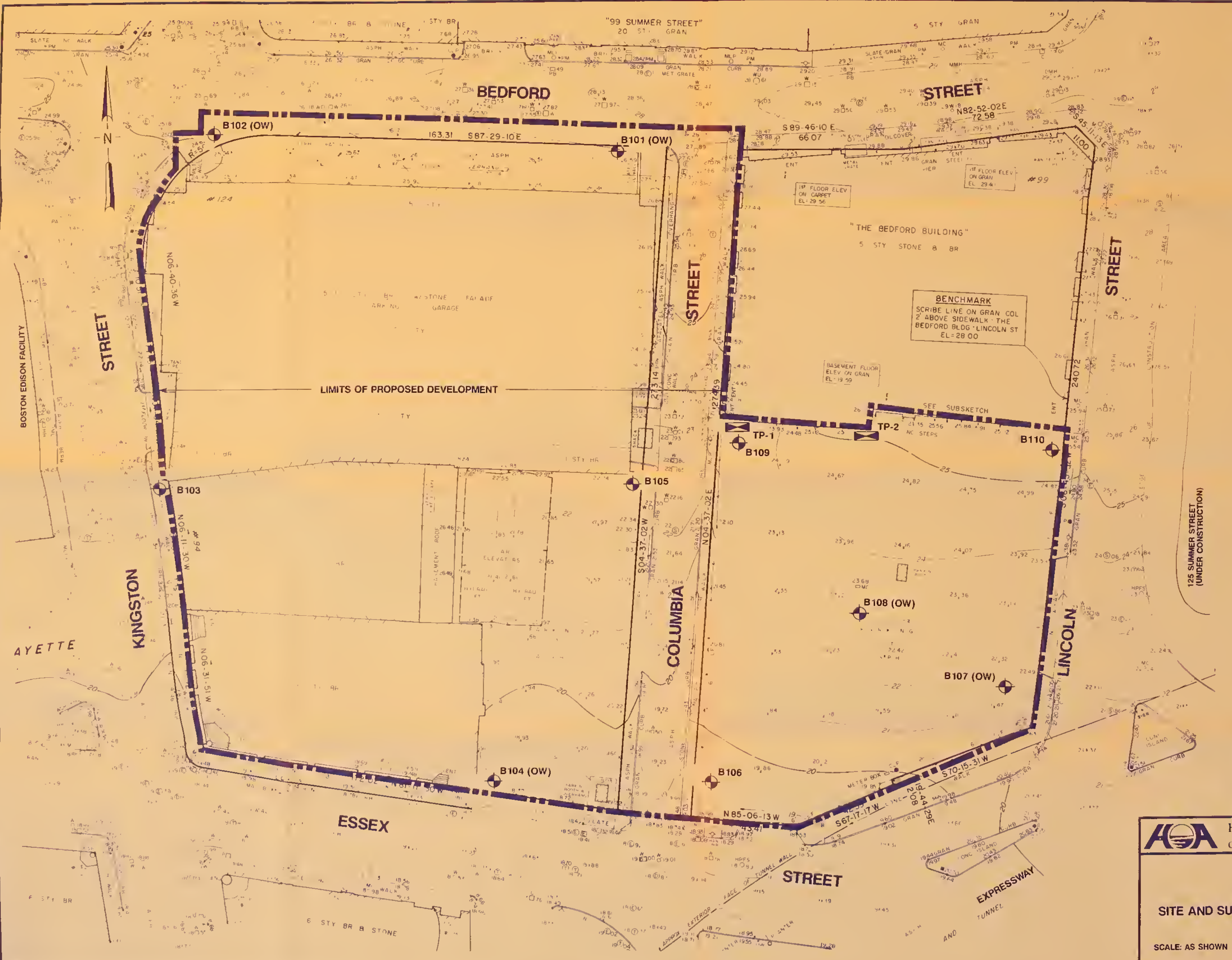
SYMBOL	EXPL. NO.	SAMPLE NO.	C_u	C_c	NATURAL WATER CONTENT(%)	ATTERBERG LIMITS (%) W_L W_p I_p	L O I (% by wgt.)	
⊙	B106	S15			9.5			
△	B110	S16			15.2			
⊡	B110	S18			10.0			

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

Kingston-Bedford Parcel
Boston, Massachusetts

GRAIN SIZE DISTRIBUTION

FILE NO. 06691 DATE: Feb. 1989



LEGEND:

B102 — LOCATION OF TEST BORINGS DRILLED BY GEOLOGIC, INC., WATERTOWN, MA. FROM 14 DECEMBER 1988 TO 13 JANUARY 1989.

TP-2 — LOCATION OF TEST PITS EXCAVATED BY CROSSROADS CONSTRUCTION, INC., MELROSE, MA. ON 14 JANUARY 1989.

(OW) — INDICATES GROUNDWATER OBSERVATION WELL INSTALLED IN COMPLETED BOREHOLE.

NOTES:

1. THIS DRAWING WAS ADAPTED FROM A PLAN ENTITLED, "TOPOGRAPHIC PLAN OF LAND IN BOSTON, MA", BY SURVEY ENGINEERS OF BOSTON, DATED 16 SEPTEMBER 1988 (DRAWING NO. 255.02L).
2. ELEVATIONS REFER TO BOSTON CITY BASE (BCB), WHEREIN EL. 0.0 IS 5.65 FEET BELOW NATIONAL GEODETIC VERTICAL DATUM (NGVD).
3. LOCATIONS OF SUBSURFACE EXPLORATIONS WERE DETERMINED IN THE FIELD BY MEASUREMENT FROM EXISTING STRUCTURES.
4. TECHNICAL MONITORING OF SUBSURFACE EXPLORATIONS WAS PROVIDED BY HALEY & ALDRICH, INC.

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

ONE LINCOLN STREET
BOSTON, MASSACHUSETTS

SITE AND SUBSURFACE EXPLORATION LOCATION PLAN

SCALE: AS SHOWN

FEBRUARY 1989

FIGURE 2